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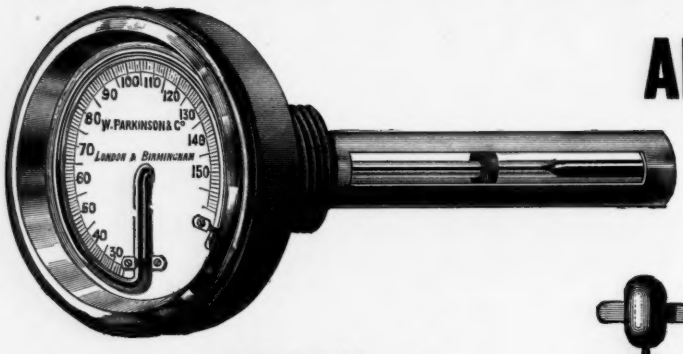

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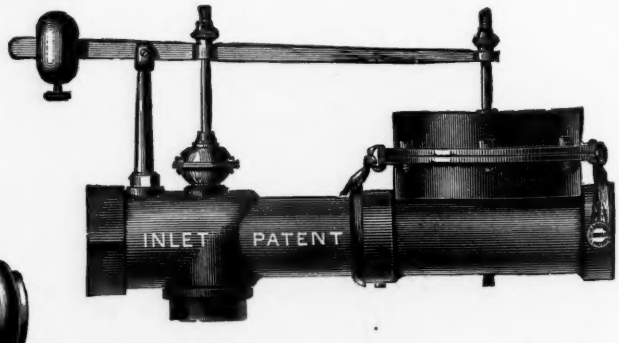

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EDITORIAL NOTES—GAS, &c.

The Publicity Campaign.

How Does the Industry Stand in this Matter.

ELSEWHERE will be found a communication from a correspondent who is in despondent mood as to the prospects of success for the Co-Operative Publicity Movement. We would direct to this matter the earnest attention of every gas manager whose Board or Committee have not yet considered the circular issued by the Publicity Committee a month ago, and of every manager whose Board or Committee are taking or have taken either an unfavourable or indifferent attitude on the subject.

We are aware that no little dissatisfaction has been felt in some quarters, and difficulty created in others, because the circulars and the accompanying letters were sent to the Chairman in every case, and not to the officers of the undertakings. The reason assigned for this course, we understand, is that there is difficulty in a number of instances of deciding whether to address the Engineer or the Secretary; it being fatal to all chance of success to choose the wrong alternative. Whether this was a sufficiently good ground for the course taken, with its obvious drawbacks, it is not profitable now to inquire. All we are concerned in—and what every engineer, manager, or secretary, whose interest in the welfare of the gas industry is above that of his own personal pride, must be concerned in—is in removing any hindrance to the success of the movement that may have been created by the method of circularization. The appeal has been printed in the Technical Press; copies can be had at once from the Secretary of the Institution; the attention of every chief officer in every undertaking has been and is hereby again drawn to the matter. There can, therefore, be no excuse for any further delay in getting the subject considered by every undertaking in the country; and if every manager will rise to the occasion, realize its exceeding importance and urgency, and put his shoulder to the wheel, we have not the slightest doubt that the pessimism of our correspondent will be proved to be without warrant.

We have heard rumours of large undertakings, of progressive repute refusing to join in the movement. Without the most unquestionable confirmation of these rumours, we refuse to credit them. This is not the time when any undertaking that has any claim to be regarded as a pioneer in the industry can possibly fail to take its place in the front rank of a movement that, advocated by most of the leading spirits in the profession, demands at least a fair trial to enable it to prove its power——to the industry, and to its enemies.

At the Forefront of the Commercial Contest.

THERE will be abundant attractive subject-matter for the Governor (Mr. Corbet Woodall) to lay before the proprietors of the Gaslight and Coke Company at their meeting on Friday. The big concern stands for much in these commercially contentious and bustling times in the life and interests of the gas industry; and through a personal influence, through a broad-minded conception of position and opportunity, and through a dogged perseverance, the internal and external power of the concern has been elevated year by year of late to the advantage of not only the undertaking itself, but of the British gas industry as a whole. The prestige of the gas industry not long ago was suffering from the stiff-necked policy, and consequently ponderous movements, of the largest unit in its composition. The tale of how this has been altered is, however, now well known; and it may be passed here, excepting to say that due acknowledgment of good work will never be withheld in these pages, despite the criticism of uncharitable envy.

But the financial and technical results of the forward movement of the undertaking, while they have a bearing on the reputation of the gas industry at large, are perhaps not generally regarded in the same light as the commercial vigour that was introduced a few years since, and that has had such wholesome effect. The Company occupy the territory in which has to be met the very head and front of the electrical competition that has spread throughout the country; and while the electrical industry may boast of having secured the bulk of the large shop lighting in certain main West-end thoroughfares, and while municipal ownership of electricity concerns has substituted electricity for gas in two or three districts, the gas sales and revenues of the Company, the reduced price of gas, and the ascending dividends, all show how successful have been the politic direction and the indomitable energy of a well-organized and technically and commercially educated staff. Since the last meeting of the proprietors, that grand demonstration of high and low pressure gas lighting (the high-pressure portion of which Mr. Charles Carpenter and colleagues of the South Metropolitan Company describe in their report to the proprietors as "fine" street lighting) in the streets of the West-end has caused the part of the public formerly ignorant of the flights of progress that gas has made as an illuminating agent to marvel, and has induced the Electric Supply Companies to start pulling down, in their agitation, their old electric arcs, and putting in their place newer types. But the contrast (take the Strand flame arcs for instance) is still not in their favour. The Company, too, by the low-pressure inverted lamps (and easy terms to the Borough Councils for the cost of conversion), have taken possession of a large bunch of considerable new contracts for street lighting for a number of years. Thus we say that at the very head and front of electrical competition, where the fight is keenest, the Company have done work meriting unstinted praise that, while serving their own interests, has had an influence that must be felt throughout the length and breadth of the British Isles. Supposing these contracts had not been won, supposing the work in the West-end that constitutes the most remarkable demonstration of street gas lighting this country has yet witnessed had not been done, supposing flame arc lamps and metallic filaments in open competition had carried off the laurels all along the line, what would have been the effect on public lighting authorities throughout the country? It is well at times to look at the reverse side of a matter, in order to give the other side its due proportions in importance.

Under these circumstances alone, the proprietors of the Company will meet on Friday with ample cause for satisfaction. They will also be asked to consider and endorse the Bill that has been printed for authorizing the acquisition of the Barking and the Chigwell, Loughton, and Woodford Gas Companies; and this annexation scheme is evidence as to the uniting of the West Ham interests and area to the larger structure having up to this point fully answered to anticipations. The step-by-step policy to more open area for the concern within which to give scope for the dormant economies of yet not fully developed resources, is one that will commend itself to the proprietors. Then another point for satisfaction to them (including, of course, the employee partners), and the consumers is the 1d. reduction in the price of gas from the beginning of the present year, which is a clear sign of dividend increment within measurable distance. There is also the 3 per cent. increase in the consumption of gas in comparison with the corresponding half of 1909, which is represented by 367,851,000 cubic feet—the total sale of the half year having been 12,639,575,000 cubic feet. Still more, there is the fact that a larger amount is carried into the accounts of the current half year by £83,318—the total being £625,688—than was brought into those for the past six months. This goes to show that the working has been good during the half year; and with cheaper gas, a large proportion of the coal for the year ending June, 1912, already having been contracted for at rates less than those for the current period, and with the market for residuals at present in good case, the proprietors (ordinary and employee) may look forward to the stability of the concern being immediately further enhanced, though in the short space of

six months it can hardly be hoped that the Company will recoup the period's share of the £100,000 or so that a penny reduction now represents on a year's private gas sales.

A few comparative figures from the accounts published last week, to show the trend of affairs during the half year, will suffice, though comparison cannot be on all-fours, owing to the figures for the corresponding half of 1909 being constituted of the results of the Gaslight and West Ham concerns under separate existence and administration. It is noticed that the net capital expenditure in the half year has amounted to £36,074; £99,642 having been spent, and £63,568 having been written off for depreciation. The revenue account contains several points of interest; and directly the figures are approached we are warned by the extra amount paid for coal of the necessity for giving consideration to the whole costs of raw materials in the case of a Company manufacturing both coal and carburetted water gas. The outlay of £555,515 for coal is an increase, compared with the December half of 1909, of £24,986; but in the next item it is seen that only £47,085 has been spent on oil, which is a reduction of £29,102. Coke and breeze used in the manufacture of carburetted water gas (costing £40,488) was more by £1758. But the total outlay on the raw materials used in the manufacture of gas was £643,088, or less by £2358 than in the corresponding half of 1909, though the make of gas (13,602,533,000 cubic feet) increased by 443,835,000 cubic feet—the additional sale, as already remarked, omitting the quantity used on the works and for other purposes by the Company, amounting to 367,851,000 cubic feet. We will not attempt to enter into the question of the quantity of coal carbonized and the oil used in relation to the gas manufactured, as the comparative figures for the material used by the West Ham Company in the December half of 1909 are not included in the statement now before us. But it is clear that the quantity of oil used (the price has, of course, also been lower) has diminished considerably, and no spirit has been employed. But the disclosures of the accounts are sufficient to show that the technical officers and the carbonizing staff and men have been continuing the tale of manufacturing improvement. With a total expenditure on manufacture of £978,819, the increased expenditure under this head was £6815; but this included upwards of £5000 extra outlay on repairs and maintenance of works, and the item of purification was also greater by rather more than £4000. An expenditure on distribution of £330,637, was £50,441 more. But it is remarked that £33,126 extra was spent on the repair and maintenance of mains and services, £4640 on repair and renewal of meters, and £17,375 on the repair and renewal of stoves; while, on the other hand, a disbursement of £33,656 on gas-fittings, including labour, for automatic meter supplies, is a decrease of £6284. Then there are variations in items produced by the special circumstances of the West Ham transfer of now rather more than a year ago; and therefore no profit can attach to following them through. In the result, however, the total expenditure was £1,607,487, which is an increase of £55,726. But the additional expenditure on repairs and renewals more than accounts for this sum.

On the other side of the account, the revenue from private consumers of gas amounts to £1,579,978, or an addition of £7549. On the other hand, the revenue from public lighting shows a decline of £7504. But when it is observed that the number of public lamps has fallen, by 2892, to 47,404—an effect of the ownership of electricity undertakings by Borough Councils—the difference in revenue is easily accounted for. We arrive at this notable point, that on balance the total revenue for gas, £1,648,207, only varies (upwards) by £45 from that of the December half of 1909. The differences in the figures under "rental" will no doubt be treated to a little explanation at the meeting. The half year has been a good one in regard to residuals—the income of £458,970 in this department being an advance of £66,549, contributed by (deducting £1217 less for breeze) an extra £41,629 for coke, an additional £12,349 from tar and tar products, and a further £13,787 for ammoniacal liquor and sulphate of ammonia. In the result, the total income of £2,299,322 is an increase of £83,886. Subtracting from this the increase of £55,726 in expenditure, and we have the £28,160 by which the amount transferred to the net revenue account (combining the gross profits of the Gaslight and Coke and West Ham Companies) is greater than it was a year ago. The amount so transferred on this occasion is £691,835. It is a good and highly interesting statement.

Chemical Control.

THE day has long since passed when in the gas industry there would be any disputation as to the advisability of making the fullest possible use of chemical knowledge and skill in connection with all gas-manufacturing operations. Chemistry and gas manufacture are indissolubly bound up together. It is only through chemistry that the fullest protection can be secured in the purchase of the raw materials of gas-works; it is only through chemistry that the fullest control can be obtained in the operations of gas manufacture. Chemistry largely supplies the index and the check throughout. To it also we have to look for progress. But these are the acknowledged things of to-day. There is now no mere distant toleration; but union is recognized as being wholly essential to the life of the gas industry. The industry, indeed, presents a vast field for the chemist, with (apart from his routine work) ever-varying interest. So large, in fact, is it, that the works chemist finds, as a rule, his routine duties sufficient to set the limits to his activities; and however much he may aspire, however earnest he may be in his wish, to participate in the attempt to solve still unsettled problems, or to assist in the exploration of those regions from which progress is realized, he has to content himself (excepting, perhaps, in the largest of works, where there is plenty of help at hand) in, for the most part, the humbler, but yet highly responsible, position of bringing his knowledge to bear upon the protection and keeping up to concert-pitch of practically the whole of the processes that are packed together in the single term "gas manufacture."

The limits of the chemist to which we refer peep out here and there in the lecture that Mr. John T. Sheard, of Sheffield, delivered at the Manchester University last Saturday, on the subject of "The Chemical Control of Gas-Works." If anyone knows gas-works laboratory practice, it is Mr. Sheard. The gas laboratory has been the scene of his professional career; and he knows the work to date of the gas-works chemist as well as he knows the place in which he pursues his daily avocations. But he indicates (he does not state it) that the manifold routine duties of a gas-works chemist, if he does his duty properly, are sufficiently time-absorbing to preclude him from going far into research work; for he points out in various places where the door is open to profitable investigation for those who have the opportunity and the ability to undertake it. He indicates, too, that there are several directions in which there are differences of opinion in association with chemical and physical questions bearing upon gas-works operations; and while there are such differences of opinion, his last comment, referring to the actions that occur in gas-purifiers, has a very general application indeed. These differences are "a caustic comment on the insufficiency and inexactness of "our knowledge." There is no one better capable than the chemist, who is daily applying his science to the practical purposes of the time, of pointing out where unsolved problems exist, where weaknesses obtain in process, or where possible openings are present for improvement and economy, but which require research for the verification of view and the assaying of the value of the economy.

Mr. Sheard's lecture was, appropriately to the occasion, of a practical character; it was suggestive; and it reflected the views and practices of mature experience. Though he only dealt with the evaluation of the raw materials and the chemical control of the operations of gas manufacture—leaving out of consideration the ordinary purity and standard tests that are the checks upon gas production, as well as the question of the scope for research—his lecture covered much ground, and yet in each constituent part it had to be compressed into narrow measure. On the proper appraisement of the raw materials of gas manufacture rest financial and efficiency considerations of great importance; and upon the chemical control of the operations rests practically the whole of the economical working of the plant. There are parts of the lecture over which there might be controversy; one instance of this being the polemical question as to the most suitable coal-testing plant. Mr. Sheard tries to say a good word for most things; but the true view must only be gathered from the complete comment. The 2¼-lb. laboratory coal-testing plant is not kicked on one side as useless. If used with skill and judgment, always providing that the sampling of the coal has been properly carried out, it is said that one can ascertain how much gas the coal will yield, and also the quality of the gas made. But the lecturer points

to many pitfalls; and it is clear he would not advocate it for telling all about the coal from the gas and residuals standpoints. He regards as the most suitable coal-testing plant one in which 2, 3, or 4 cwt. of coal may be carbonized. His *confrère* at Birmingham (Dr. Davidson) would be prepared, from what he learned at the meeting of the Institution last June, to tell Mr. Sheard that experienced carbonizers, like Mr. Charles Carpenter and others, argue that, under the modern practice of the heavy charge and the rapid charging and discharging of retorts, a hand-charged retort holding 2, 3, or 4 cwt. is not adequate, and that it is better to have a separate bed of retorts in a retort-house of full working scale, and subjected to the ordinary round of mechanical operation, to get to the whole tale of the capability of the coal. In this connection, there are other points which will be subject to differences of opinion. There are several hints, too, in the lecture. As an example, again, may be mentioned the one comprised in the results of an experiment which show the importance of the physical condition of oxide of iron in purification. The experiment was with burnt spent material; and it is seen from the results that the finer it is ground, the more active is it in the absorption of sulphuretted hydrogen.

The object of the engineer should be to get the utmost possible economy out of the fuel and plant he uses; and, in enabling him to do this, the chemist has most important part. But why emphasize truisms? The importance of the part the chemist takes in exercising control is fully and freely acknowledged; and therefore it will be that the greatest value will be put upon the reflections in this section of the lecture of a ripe experience as to methods and practices. A most interesting suggestion, however, is made when the lecturer points out the paucity of information existing on the conduction of heat through the walls of retorts; and he shows that here there is scope for research in trying to effect a saving of the time of carbonization by improving the conductivity of the retort material. It will be remembered, as bearing upon this point, that Mr. Thomas Glover, in his Presidential Address at the Institution meeting in 1909, showed that carbonization—which also means a saving of time—proceeds more rapidly the narrower the retort. So we go on through the lecture, obtaining light here and suggestion there, and rays of personal opinion, mixed with non-committal expressions—such as over the Feld and Burkheiser purification processes—where personal experience or decisive results do not come to aid in forming a definite judgment. Mr. Sheard is a whole-hearted progressive in gas-works affairs; and he sees in such things as the removal of the sulphur compounds restrictions and the lowering of the standard of illuminating power the pathways to higher economies and utility. In the forming of these pathways, the gas chemist has had a no mean part.

Commonsense Illumination.

Commonsense and scientific are synonymous terms when applied to illumination. Progress has been made at such a rate lately in illumination and in the knowledge of requirements, that some of those who fit up premises with the means of lighting—we are not referring to gas any more than to electricity—have not yet woke up to the fact that there is something more to be considered in planning an installation than the single end of architectural convenience. Of all considerations in illumination, the purpose for which the artificial light is required, and the convenience of those using the lights, are of paramount importance; and if they have their rightful position in the ultimate installation, there will be commonsense illumination. The discussion that has taken place at the last two meetings of the Illuminating Engineering Society in conjunction with the Library Association has concluded; and it has been useful, not only in bringing together the loose ends of knowledge on the subject of suitable methods of lighting public libraries, but in (as we were in effect saying a fortnight since) emphasizing the fact that haphazard illumination has had its day, and that it is going to be superseded by something conforming with rules of quite another order. We know now about what may be taken to be the general requirements. They are that the quantity of illumination required on tables and desks in reading and reference rooms is (say) 4 to 5 foot-candles, and that the book stacks demand (say) 1½ foot-candles. Also that the eyes of the users of public libraries must be fully protected from the rays of injurious lamps. There is, however, disagreement between the professors as to whether general lighting is sufficient, or general lighting *plus* point lighting necessary. There is also a question as to whether or not a standard of lighting shall be taken and that be deemed adequate for all purposes, or whether the idiosyncrasies of readers and others and the varied character of print, drawings, and paper should be catered for in the arrangements.

It must be remembered that to a considerable extent public libraries are electrically lighted owing to municipal ownership of electricity undertakings; and through the years that the places have been lighted electrically, all the factors that are recognized as essential in governing installation and use have been roundly abused, with the result that no one seems to be able to point to a public library electrically lighted, and say "there is something worthy "of emulation." The agitation for improvement in lighting libraries seems to come entirely from the officers in charge of electrically lighted libraries, and the strongest support is given to them by those who outside the meeting place profess and call themselves electric lighting experts. The change from one form of electric light to another has brought us to a point where there is almost absolute concord in urging that the general lighting shall be (where electricity is employed) of the reflected kind, and that the point lighting where metallic filament lamps are used shall have deep shades—shades wonderfully and skilfully formed—fitted around them to protect the eyes of the readers, and to better diffuse the light. The electricians are fully conscious of the defects of their lamps; and they fully realize that they cannot be cured—palliation being only obtainable through increased cost. It is said that, in considering illumination, idiosyncrasies of people should not be considered. Seeing that they can be provided for at reasonable expense by giving them local adjustable lights, then why not? It seems to us that our electrical friends are here setting themselves to be deliberately inconsiderate. Visual idiosyncrasies are being created by the newer forms of electric lamp; while it is so easy to avoid this, and to supply the varying requirements, of vision and of print, drawings, and so forth, by another form of light, that is readily adjustable by the user himself. If we are going to be impartial illuminating engineers, then let us live up to our profession.

It is clear then that what is wanted for the special purpose that has been discussed is an economical light; for general lighting, a light that will not torment or injure the eyes; and for point lighting, instead of a definite unit, lamps that can be individually adjusted within the limits of a reasonable range of illuminating power. If there is not this adjustability, then we shall hear more of that rapid degeneration of eyesight that, it is freely confessed, is being caused by the modern forms of electric lamp—in banks, schools, libraries, and other places where much work is done by the aid of the electric lamp. There is a responsibility in this matter that few, it is plain, care to own up to—electrical engineers the least, in view of the fact that the mitigation of the defect means extra expense to the user.

Railway Transport Differences.

The decision of Lord Mackenzie and his fellow arbiters in the matter of the reference to them of the points in dispute, regarding demurrage and sidings rent, between traders and the three leading Railway Companies of Scotland, will, we think, influence largely any further combined action by the municipalities north of the Tweed owning gas-works. The principal heads of the recent decision were published in our "Miscellaneous News" columns last week. It is apparent, now that the evidence is available, that so far as ordinary traders are concerned, the Railway Companies were quite justified in levying their new demurrage and sidings charges; for the tightening of the screw has had a most remarkable effect in placing at the Railway Companies' command surplus waggons to such a number that they have difficulty in finding storage accommodation for them. It almost looks as though a great deal more capital than is economically desirable has been invested in rolling stock for the conveyance of materials and goods. But this, at all events in Scotland, bears seriously on the private ownership of waggons. The Court of Appeal here in London recently, as Mr. Balfour Browne, K.C., was pointing out at the last meeting of the Society of British Gas Industries, have decided that the Railway Companies are not compelled to accept private owners' waggons, so long as they can supply an adequate number themselves; and the Commissioners who have been

considering the points at issue in Scotland have determined that they cannot impose any obligation on the Companies to accept private owners' waggons, so long as the Companies can offer a sufficiency. The chief effect of the new scale of demurrage and sidings charges having been to reduce the detention of railway waggons, and to cause them to be hurried back into the Railway Companies' possession, the latter are in a stronger position than ever for exercising their optional power of accepting private waggons. Of course, if climatic conditions or error on the part of the Railway Companies' servants are the causes of delay, then the Companies are not to be entitled to inflict full-time charges; and failing agreement, there will have to be reference to arbitration.

The municipal gas undertakings did not take any part in the present application; but the result of it (there has only been a little stretching of the free time, but the charges imposed remain) will of a certainty affect their future action. They can only make a special appeal in virtue of their own special circumstances. It has been the contention all along that they, having a continuing coal traffic year in year out, and with works equipped for a reception of coal within reasonable limits day by day, should receive special consideration—more particularly as the coal traffic to gas-works is often delayed through the exigencies of excursion and other passenger traffic, with the result that an accumulation of trucks is sent into the works beyond their capacity for dealing with them without adding considerably to the expenses of coal handling. Their position is not identical with that of ordinary traders; and special circumstances should have a right to special consideration. But it is a dubious point whether, in view of the decision in the appeal of the ordinary traders, the gas undertakings will collectively secure any favourable consideration, but only individually may obtain some concession on a specific case of hardship. The attitude of the gas undertakings, however, remains to be seen. Last year, in view of the application of the ordinary traders, it was determined to postpone taking further steps; but the right was reserved to apply later for the appointment of an arbitrator, on the understanding that the taking of this course was not to prejudice the gas undertakings. That is the position to day.

Points at the Tottenham Meeting.

Some peculiarly interesting, not to say remarkable, subject-matter constituted the speeches, at the meeting of the Tottenham and Edmonton Gas Company last Saturday, of the Chairman (Mr. Corbet Woodall) and his deputy (Sir D. F. Goddard, M.P.). To pass in review here these interesting points would mean the practical reproduction of the report that is presented in our news columns. But special attention may be directed to the extraordinary record in the Chairman's address as to the growth of the business of the concern during the first decade of the century, illustrating progressive economy and expansion the equal of which perhaps few other gas undertakings can show in the span of ten years. The whole of the figures are worth consideration. Bearing upon this matter, the Deputy-Chairman emphasized, too, how the extended uses of gas in the daytime had added to the security of the gas industry, and to that of the investment in it. The value of a renewals fund for special displacements and renewals was also exemplified by the Chairman. A matter that is now under the consideration of the Engineer (Mr. A. E. Broadberry) is the reduced weight of coke that he has now for sale per ton of coal carbonized; and the Chairman suggested that this may be partly accounted for by the fact that, under the present methods of working, the coke contains less moisture than formerly, which is a distinct gain to the consumer. As to prospects, the Directors have (as in the case of the Gaslight and Coke Company) taken advantage of opportunity, and entered into contracts for a large proportion of the coal and oil that will be required in the year ending June, 1912, at lower prices than those that rule under current contracts. The strength of the residuals market continues encouraging; and a further reduction of the price of gas to the consumers is on the *tapis*.

Increased Consumption per Consumer and Cost.

But this brings us to a point dealt with by the Chairman towards the end of the proceedings. He spoke of the general impression that, owing to the use of consumption-saving incandescent gas-burners, householders use less gas than formerly for lighting. An investigation by the Secretary (Mr. E. Topley) proves the contrary—at any rate, in the case of the Tottenham and Edmonton Company's district. He has found a number of consumers who ten years ago used gas for lighting, and that is the only purpose for which they still consume it. The average consumption, in the case of these consumers, ten years ago was 32,000 cubic feet; while last year it was 37,000 cubic feet. But there is a point about this which the Chairman did not mention; and it is this that, owing to the reduction of the price of gas in the ten years from 3s. 4d. to 2s. 3d. per 1000 cubic feet, the average payment by these consumers has declined from £5 6s. 8d. for the 32,000 cubic feet to £4 3s. 3d. for the 37,000 cubic feet—a saving of £1 3s. 5d., although a greater quantity of gas is burned. The reasons that these consumers use more gas are not far to seek, despite the probable application of more economical burners. There has been a gradual growth of the desire for more light; and the lower price of gas has encouraged the more constant use of a larger number of burners about a house. There is another satisfactory figure. The average use of gas by a further number of consumers for lighting only ten years ago was 33,000 cubic feet. Since then cooking and other heating appliances have been installed; and the consumption has risen to 52,000 cubic feet. At the price ruling for gas ten years ago, the 33,000 cubic feet cost the consumer £5 10s.; at the price ruling to-day, the 52,000 cubic feet only cost £5 17s. That is to say, the extra consumption, with all its conveniences, only costs 7s. more than the total paid ten years ago for an amount of gas 19,000 cubic feet less. We hear a lot in these days about encouraging the use of gaseous fuel in aiding in the prevention of the contamination of the atmosphere; but a little more might be said as to the effects in economy to the householder of extending the use of gas as a fuel. Such patronage assists in the economical production that results in the remarkable effects to which reference has just been made. There is another aspect. The Tottenham Company supply gas of lower illuminating value than formerly; and the "Metropolitan" No. 2 burner is the standard means by which it is consumed in testing that value. The figures quoted are an answer to those who have, without any statistics with which to substantiate their statements, contended that the new conditions are not to the economic advantage of the consumer.

Public Lamp Control by Pressure Devices.

An important point in connection with the question of pressure-lighting devices for street lamps is their capability in successfully meeting considerable variations of pressure conditions. The matter has frequently been raised; a recent occasion being during the correspondence evoked by a contributed article on automatic street lighting in our columns. Among the letters was one which promised to show how the "Automaton" pressure lamp-lighter has proved its ability to contend, with certainty, with wide variations. The promise is fulfilled this week. An article appearing in other columns is accompanied by a set of pressure-charts, showing among the samples some extraordinary diverging conditions that the lighter is capable of meeting. If faithful performance can be secured under such conditions as those portrayed, then we fail to conceive any circumstances that cannot be met. We have no special interest in one lighting arrangement over another; the best one, or the best types, will prevail for such a purpose, on merit alone. But the article before us does illustrate, in a graphic way not attempted before, that the main ground of fear in connection with automatic street lighting, using pressure as the operative force, has been thoroughly negotiated by inventive ingenuity. It is not a question now of gas engineers altering their conditions to permit the use of an automatic controller; the latter can be so adjusted as to suit any set of pressure conditions. To say the least, the variety of conditions that can be met is marvellous, and not less so is the simplicity, the mechanical precision, and the efficiency by which it is accomplished. Gas engineers are realizing that a considerable saving of labour and gas is effected by the use of a good lamp controller; and there is nothing, next to good illumination, more attractive to the public about street lighting, than to see the lamps at dusk all lighted up simultaneously.

A Hospital Lighting Question at Wellington (N.Z.).

Copies of New Zealand papers just to hand show that there has been an agitation in Wellington over the question of lighting the Hospital. It appears that at a meeting of the Hospital Board last November a decision was come to, on a recommendation of a

Committee, to renew the Gas Company's contract for lighting for five years, instead of seven as under the previous contract. The reason assigned for the change was that the completion of a water-power scheme by the Government might enable the Board to make a better bargain. The City Council, who have an electric light undertaking, were not asked to tender; but learning the decision of the Board, the Electric Light Department bestirred themselves, and some of their officials visited the Hospital, and supplied the Committee with certain information which led them to recommend the Board to rescind their resolution, so as to allow time for a thorough investigation of the question. This recommendation was adopted by the Board, who added four members (three of them being councillors) to the Committee. In order to secure the lighting of the Hospital, the Electric Lighting Department offered to supply current at 3d. per unit, which is 2d. less than the charge made to their two largest customers—the Government and the Harbour Board. A long letter, setting forth the case for gas, has been addressed to the Secretary of the Board by Mr. William Ferguson, the Managing-Director of the Gas Company, who supports his remarks by some very significant figures. He shows that, both for lighting and heating, gas will be less costly than electric current; and he submits that, if the contract is to be let on grounds of efficiency and economy, it should be placed with the Company. The subject has been much discussed in the local papers, as it raises the question of municipal trading in opposition to private enterprise. The Electric Lighting Department have cut their price below paying-point so as to get business away from the Gas Company; and it is being recognized that by so doing they are fighting an important section of the ratepayers with their own money.

A Proposed Coalowners' Federation.

Wide attention has been given during the past week to a statement made by a correspondent of the "Morning Post" to the effect that active measures are now being taken which will at an early date result in the creation among coalowners of the country of a federation as national in its character and in some of its aims as the Miners' Federation of Great Britain. The writer says he is not at liberty at the moment to give further details of this important movement, except to add that arrangements have already been completed by which the coalowners of one particular district will, in their resistance to demands which have already been made upon them by their workmen, receive external financial support. In view of the powerful organization, including every coalfield in the country, which is at the service of the men, there seems little reason to feel surprise that the owners should make a serious attempt to combine in a similarly comprehensive manner for the upholding of their claims. Last year, there were numerous threats of a national strike, which the Miners' Federation were in a position to carry out more or less thoroughly had they finally decided to do so. The most effectual way of safeguarding the mining industry in the event of a crisis of this character, would undoubtedly be by the creation of such an Owners' Federation as would permit of the colliery proprietors fighting the men with their own weapons. In less serious cases, too, the owners would be in a stronger position to deal with the men's demands if they did so through an organization which was in a position to speak with one voice for the masters throughout Great Britain. It is, indeed, almost inevitable that the building up of a strong fighting force on one side should sooner or later lead to the adoption of similar tactics on the other. But the movement now on foot should not only be a good one from a fighting point of view. It should also make for peace, by rendering more difficult the sectional disputes which have of late been such a source of trouble to the coal-mining industry, and by enabling the masters and men to negotiate on more equal terms.

The Position of Trade Unions.

Some statistics which show the position of Trade Unions at the end of 1909, as compared with the previous year, appear in Part C. of the reports of the Chief Registrar of Friendly Societies for the twelve months ending Dec. 31, 1909. All those organizations, it may be pointed out, which avail themselves of the advantages conferred by registration under the Trade Union Acts are required to furnish annually to the Registrar of Trade Unions (who is the Chief Registrar of Friendly Societies) a general statement in a prescribed form, showing fully the assets and liabilities at Dec. 31 in each year; the receipts and expenditure during the year preceding that date; and, in regard to the latter item, separately the expenditure in respect of the several objects of the Union. These returns have to be certified by Auditors appointed as provided by the rules of the respective Unions; and they are the only returns of their financial transactions which registered Trade Unions are under any statutory obligation to furnish. At the close of the year 1909, there remained upon the register 666 Trade Unions; and of these, 638 furnished returns. The total membership for Great Britain and Ireland of the 638 Unions was 1,957,904; their income amounted to £3,042,421, and their expenditure to £3,158,698; while the funds at the end of the year were £5,886,272. The figures for 1909, compared with those for the previous year, show a decrease in membership of 13,334, or 0·676 per cent., a decrease in income of £253,520, and a decrease in expenditure of £565,788. During the year 1909, the expenditure of the Unions exceeded the income by £116,277. The average gross income per member was £1 11s. 1d.; and the amount of funds per member, £3 0s. 2d. The progress of the Trade Union movement during the three decades ending Dec. 31, 1909, will be seen from the following figures. In 1879, the number of returns was 149; in 1889, 196; in 1899, 646; in 1909, 638. The number of members in 1879 was 237,889; in 1889, 592,858; in 1899, 1,436,283; in 1909, 1,957,904. There was in 1879 a total income of £280,434; in 1889, of £830,386; in 1899, of £2,097,863; and in 1909, of £3,042,421. The balance of funds in 1879 was £291,050; in 1889, £956,486; in 1899, £3,515,067; and in 1909, £5,886,272. During 1909 there were 29 Trade Unions registered; while 27 were dissolved or gave notice of termination. In the list of the Unions, one notices under London the National Union of Gas Workers and General Labourers of Great Britain and Ireland, with a membership at the end of 1909 of 31,735; and in Birmingham, the Amalgamated Society of Gas Workers, Brick Makers, and General Labourers, with a membership of 3400, and the Gas-Fitters' Trade Association, with a membership of 80.

A Municipal Superannuation Scheme.

A number of towns already possess power to establish superannuation funds; and Halifax is anxious to be added to the list. There has therefore been included in a Bill which the Corporation are promoting in Parliament a scheme based on that in operation at Newcastle, but with some important variations. In character it is contributory and voluntary; and every employee can join it. The main proposition entitles to a superannuation allowance those who become incapable of discharging their duties by reason of permanent infirmity of mind or body, or who shall have attained the age of 60 years and have completed an aggregate service of 40 years, or shall have reached the full age of 65. On the ground of old age, 60 years is the earliest retiring age; and anyone in receipt of an allowance is barred from taking office under a rating authority. Where an officer or servant has reached the age of 65, the Corporation may require him to retire on his allowance. The scale of contributions for those at present in the service range from 3 to 4½ per cent. of salary or wages, according to years of service. The retiring allowance is one-eightieth of the salary or wages for every completed year of service. Generally speaking, no one will be able to draw upon the fund until he has contributed for ten years; but men over 55 years old when the scheme comes into practice will receive the allowance for the years they have contributed. Except where an employee has, on account of infirmities, accepted a post at a smaller remuneration, the pension will be reckoned on the average salary or wages for the past five years. Service under other local authorities will count for pension; but additional contributions are demanded. The Corporation will pay into the fund annually a sum equal to the contributions of the employees, but not in excess of £500 a year. Should the money at the credit of the fund be inadequate for the demands, the deficiency is to be made good from the rates. It will be noted in connection with the scheme that the retiring allowance is in eightieths of salary, instead of the usual sixtieths.

According to the "Pharmaceutical Journal," to preserve rubber tubing it should be immersed in a mixture of one part ammonia and two parts water for a time varying from a few minutes to half-an-hour or an hour, until the original elasticity is regained. Keeping the goods in air-tight vessels will preserve them for a long time; and so will well-closed tin boxes containing quicklime and ammonium carbonate.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 391.)

Business on the Stock Exchange last week was much below par in point of activity; but the prevailing tone was very good, and many strong points were apparent. The steady cheapening of money was a potent factor, and choice investment securities felt its warming influence. Railways were rather daunted by the threatened strike in the North, which was looking serious on Saturday. Several speculative lines were much stronger, including Breweries, Mines, and Rubber. The opening day was very quiet, and the tone was lower in many departments. Government issues were irregular. Consols fell $\frac{1}{8}$ for money, and rose $\frac{1}{8}$ for the account. Railways were uneven; Americans were weak. Things were again quiet on Tuesday and inclined to be dull. There was, however, some demand for gilt-edged investments. Wednesday was quieter still; and again the leading lines were well supported. Railways were better. There was a general advance in gas quotations, to which further additions were subsequently made daily. On Thursday, the general attitude was much the same. Consols rose $\frac{1}{8}$. Friday was quite cheerful, unchecked by the usual amount of realizing. Many prices advanced, especially in the Miscellaneous Market. Saturday was very quiet; but the general tendency was favourable. Consols rose another $\frac{1}{8}$; and many departments were stronger. Railways were uneven under the conflicting influences of good traffics on the one hand and strike fears on the other. In the Money Market, the tendency was steadily downward and rates for short loans and discount eased away very materially. Business in the Gas Market was good—well up to the mark in point of volume; and the general strength was exemplified by advances in the quotations of every description. In Gaslight and Coke, the ordinary was active and very firm—all transactions being within the limits of 107 and $107\frac{7}{8}$. The secured issues were quiet; the maximum changing hands at 88 and $88\frac{3}{4}$, and the preference at from $103\frac{7}{8}$ to $104\frac{1}{8}$. South Metropolitan was firm and unchanged at from $121\frac{1}{2}$ to $122\frac{1}{2}$. In Commercials, the 4 per cent. was done at from 113 to 115, with a rise of 1 in both capital issues. Among the Suburban and Provincial group, Alliance and Dublin marked 83, Brentford old 257 (rise of 3), ditto new 201 (rise of 2), Brighton ordinary $160\frac{1}{2}$ (rise of 1), British $44\frac{7}{8}$, South Suburban $121\frac{1}{4}$, and (on the local Exchange) Newcastle 102. Other Suburban and Provincial advances were in Brighton, Ilford, Sheffield, Southampton, Tottenham, and Wandsworth. In the Continental companies, Imperial was unchanged at from 185 to $186\frac{1}{2}$, Union was done at from 93 to 94 (a rise of 3), and Tuscan at 9 and $9\frac{1}{8}$. Among the undertakings of the remoter world, Bombay changed hands at $6\frac{3}{4}$, Cape Town at $3\frac{1}{2}$ (a rise of $\frac{1}{2}$), ditto preference at 6 (a rise of $\frac{3}{4}$), Monte Video at $12\frac{7}{16}$, Primitiva at from $7\frac{7}{16}$ to $7\frac{8}{8}$ (a rise of $\frac{1}{8}$), ditto preference at from $5\frac{5}{16}$ to $5\frac{15}{32}$, and San Paulo at $15\frac{3}{4}$ and $15\frac{7}{8}$—a rise of $\frac{1}{4}$. Other advances in quotation were in Malta, Melbourne, Oriental, and Ottoman.

ELECTRICITY SUPPLY MEMORANDA.

Contradictions—Competition Illegalities—Alarmed by High-Pressure Gas—"Metalite" Truths—Public Inquiry not Wanted.

It is a curious thing that, when an electrician touches the question of the relative efficiencies, virtues, and the contrary of gas and electricity, he always succeeds in finding most extraordinary phenomena attaching to the use of gas. Until electricians came upon the earth, humanity had not the faintest notion what the use of gas meant to it in regard to health and a premature dispatch from the animate world; nor did humanity know what fantastic escapades gas was capable of. We know now, because electricians—who would not profess to have ever been in a gas-lighted room, or to have eaten a gas-cooked dinner, or to have walked in Victoria Street, St. James' Street, or anywhere near Piccadilly since high-pressure gas-lamps have been installed there—have told us all about it. But they are contradictory fellows these electricians; and Mr. W. W. Lackie, who we have always put on a little pedestal as one of the commonsense electric central station engineers, has lately been testifying that he is not immune from certain little inconstancies of his kind. As readers of the "Memoranda" are aware, he is the Electrical Engineer to the Corporation of Glasgow; and he has been presenting some notes on the "Everyday Uses of Electricity" (which notes sadly require revision) before the Glasgow Section of the Institution of Electrical Engineers. One section of the notes deals with ventilation. He states that "if one ascends a ladder to hang a picture in a room where a gas-flame of any kind has been burning for a few hours" [mark the few hours], "the high temperature of the upper air is at once realized." Of course, people do not live on the top of a ladder near the ceiling of a room. It would be most uncomfortable and unnatural. But that is not the point. A most peculiar thing happens to that top hot air. It does not, according to Mr. Lackie, stay up near the ceiling. By some inexplicable freak, that high temperature air refuses to impart heat to the ceilings and walls sufficient to cause them to sustain the hot air at the top of the room. Quite the contrary thing happens, according to this scientific luminary. When the hot air rises to the ceiling, it is cooled there, and falls again, to be again heated, and so on. What a pity gas people cannot arrange for electricians to do their picture hanging at the moment of the collapse of the hot air to the lower regions. However, there seems to be a sort of concertina action going on by the air of the room in which a gas-jet is used.

But we live again. "The gas-jet," we read, "does not affect the lower air in the room; and it is the lowest air in the room that most needs renewal." That is to say, it does not matter so much what is up above, so long as the lower air is frequently changed. Just before this last quotation, Mr. Lackie states that where a coal or gas fire is used, he is quite certain that the air within 12 inches of the ceiling is not renewed once an hour. When he said that, he must have been unconscious of the point as to the falling of the fickle heated air after it had been under the cooling influence of the ceiling. But, using coal and gas fires, he asserts that "the probability is that the lower strata of air are renewed sixty times an hour, the air 3 feet up twenty times an hour, and 6 feet up twice an hour." This seems all right and proper, as Mr. Lackie says "it is the lowest air of the room that most needs renewal," and that is the part of the room in which people move and have their being. It would seem from this that an incandescent burner and a gas-fire form a very happy combination for maintaining healthy conditions in the part of a room where people live when they are not on the tops of ladders hanging pictures at night time. This same gentleman says "the ideal method of ventilation is to draw off the vitiated air at or near the ceiling." We agree with him. But he advocates the use of electric fans and blowers for driving fresh air in on the one side, and drawing the foul air out on the other. It is at night time when ventilation is most required, as then, as a rule, more people are assembled in the rooms of a house. Why not use for ventilation purposes the gas-jet and the gas-fire? They would be more economical than electric fans and blowers. Mr. Lackie admits the suction effect of the gas-fire; and he admits that the gas-jet causes the heated and respiration-contaminated air to rise. Thus a simple ventilating outlet near the ceiling would do the trick. In the same paper, much is also said about the cheapness of cooking and heating by electricity in comparison with coal or gas. A part of his audience (this was a meeting of electrical men) took what he had to say *cum grano salis*. He should read the recent series of articles on the subject in the "Electrical Times," by an electrical man who has gone in for domestic electrification, making some allowance for the writer's electrical bias and enthusiasm. Comparisons were also made by Mr. Lackie as to the cost experiences with the electric drive, in comparison with the figures of manufacturers of suction-gas plants. But a manufacturer who was present at the meeting showed that his gas-engines at any rate saved him money in comparison with what would be the cost with electricity at 1d. per unit. We are not ourselves disposed to support some of the figures that have been seen in the advertisements of certain makers of suction-gas plants; so that Mr. Lackie may be left to be dealt with by those more directly interested than we are.

The question of the legality of some of the business-getting methods of electricity undertakings has been considered from time to time in these columns; and in a special article in the "Journal" as far back as Feb. 25, 1908, Mr. V. R. Balfour-Browne discussed certain phases of the subject. The point was raised by him as to whether house agents who accepted commission from electricity suppliers for influencing new tenants to become electricity users were not violating the Prevention of Corruption Act, 1906, which makes it a misdemeanour for any "agent to corruptly accept or obtain, or to agree to accept or attempt to obtain, from any person for himself or any other person, any gift or consideration as an inducement or reward for doing, or forbearing to do, any act in relation to his principal's affairs or business, or for showing or forbearing to show favour or disfavour to any person in relation to his principal's affairs or business." The view of the learned Counsel was that if the house agent was the agent of the person taking the house, acceptance of a gift from the electricity suppliers would clearly be within the section quoted; but whether he was the agent of the tenant or of the landlord, the acceptance of a commission would be perilously near the line. The discussion in those days of the question of illegal proceedings on the part of electricity suppliers in obtaining business is brought to mind by a question recently asked in the Sheffield City Council as to whether it was legal for the Electric Light Committee to offer to supply consumers with the electric light on the condition that they discarded all other means of illumination, and which condition was supplemented by the one that accounts be rendered monthly; the consideration to be allowed for complying with these two conditions being 50 per cent. discount. Such an amount of discount in connection with a retail business is an unusual one; and it is placed at the amount named for the purpose of influencing not only prompt payment, but the entire eviction of gas, or other illuminating agent. The Town Clerk's opinion was given very guardedly. He said he was of opinion that the Electricity Committee were within their legal rights in allowing discounts, having regard to the circumstances under which they did so.

The arrangement raises several interesting reflections, in addition to the one as to the large discount being offered with the view of obtaining the complete rejection of a competitor. It is one of the principles of Parliament to-day to insist that all rebates or discounts shall be alike under all similar circumstances, and that there shall be no preferential treatment where circumstances are similar. Supposing all the existing electricity consumers who are using no other form of illuminant came forward and demanded the 50 per cent. discount, being willing to pay monthly and that

promptly, we fancy the Committee would be in a bit of a quandary. Then making this large discount conditional on the agreement to discard all other illuminants deprives consumers of the legal right and protection with which Parliament has invested him, of being able to demand from either the gas or electricity undertakers a supply of their commodity under conditions specified in the governing Acts. There was a case not long since in a southern town where litigation was close upon the parties, when one of them considered it prudent to beat as dignified a retreat as possible. The electricity suppliers had been working an agreement of which one of the conditions was the sole use of electricity, and no other means of illumination. No doubt for some very good reason a consumer desired to have gas back again in his premises. The gas suppliers could not legally refuse his demand; and then came the trouble. But after pecking at the untenable position which the condition had created—well, it was seen that the most dignified proceeding was not to let the world know what the Law Courts were likely to think of the arbitrary proceeding on the part of the electricity suppliers. The General Acts lay down the conditions on which any occupier of premises can demand a supply, and the conditions on which the suppliers are to furnish what is required. But these conditions do not give any right to make it obligatory on the part of occupiers of premises to give up all other forms of lighting. To say the least, such a condition made by electricity suppliers, if sustainable, would deprive the local statutory gas undertaking of a right that has been clearly bestowed upon it by Parliament.

Things have not lately been going well with the Electricity Committee of the Islington Borough Council; and the Chairman and members have been showing a painfully raw side. The Chairman of the Committee (Alderman Vorley) not long since committed an indiscretion. He compared the candle power per mile of expensive arc lamps, flame and otherwise, with the candle power per mile of low-pressure incandescent gas-lamps run at a comparatively small cost! A few comments, more or less pointed, were made on the Alderman's performance. Then the Council would not consent to a recommendation of the Committee which appeared to be carrying them into direct conflict with private traders. The Committee forthwith proposed to resign *en bloc;* but they were informed that their resignations must be individual, not collective. This stayed the impetuous rush to get relieved of office, and gave the remainder of the Council time (while keeping in the background what they thought of the Committee's methods) to assure the members of the Committee that they were all jolly good fellows. They succumbed to the soft impeachment, and kept on their functions. But there is fresh trouble. There is alarm in the camp at the substitution of high-pressure gas lighting for electricity for the exterior lighting of shops; and the conversions that have taken place have meant financial loss to the Committee. In the face of this, the Council, on the invitation of Alderman Vorley, have asked the Committee to consider what steps shall be taken in view of the pressing circumstance. The alarm does not pair well with Alderman Vorley's taunt to the effect that the Electricity Department have taken more from the Gaslight and Coke Company than the latter have retrieved from them. We do not see much in the remark. Something substantial has happened to cause the Committee to want to consider the nature of new defences against high-pressure gas; and the Chairman's statement shows that the Gas Company have excellent ground on which to work in furthering the cause of reclamation. High-pressure gas lighting for shops is being introduced apace. In their half-yearly report, the Directors of the South Metropolitan Gas Company refer to brilliant examples that they have put in lately at Streatham and Lewisham, to the infinite delight of the shopkeepers, who do not like collapses of illumination during the hours of business when artificial lighting is requisite, and they are also learning much about the uncomfortable effects of flickering and glaring flame arcs. A few of them, too, have noted that, in foggy weather, the coloured light of the ordinary flame arc makes the fog about their shop windows look much like smoke. The clear, penetrating, and yet soft, light of high-pressure gas-lamps is preferred. Hence the popularity of parade lighting in various districts and suburbs in and around London—north, south, east, and west.

The reckless statements that were made at the time Metalite, Limited, was floated, for the purpose of running a metallic filament lamp of that name, will be remembered by our readers. The lamp performed such economical wonders, on paper, that no doubt a few gullible ones thought that gas lighting was going to be swept off the face of the earth. We exposed at the time the fallacious statements that were being dangled before the public for the purpose of scooping in capital; and there was not one of our electrical contemporaries who could defend the assertions then made in the name of electricity, and there was not one who had the courage to tell the promoters of the concern what was thought of their outrageous proceedings. The "Electrical Review" attacked the financial part of the venture and the hyperbolic prospects; and it has recently been letting a little light fall on the widely-advertised success of the Company in its appeal to the public. It was announced that the capital had been over-subscribed. However, it appears that the general public were not after all largely trapped by the profusion of merit and prophecy with which the Company was launched for better or for worse. The Company was formed to take over the businesses, &c., of the Bryant Trading Syndicate, Limited, and International Filaments, Limited. The prospectus of Metalite, Limited, invited offers for 380,000 £1 shares; and the minimum subscription on which the Directors were to proceed to allotment was fixed at 150,000 shares. The Electrical Trust, Limited (whose nominal capital is stated at £2500), appears to have been largely interested in the promotion. This concern agreed to underwrite the subscription of 150,000 shares at 9 per cent. commission, payable in cash; and they were also to receive cash, for preliminary expenses, to the amount of £18,000. This appears to be how the successful issue is accounted for: At Nov. 30 last, shares allotted to the Bryant Trading Syndicate, Limited, and International Filaments, Limited, £284,416; shares allotted to the Electrical Trust, Limited, £14,925—total, £299,341. Blocks of shares also stand in the names of brokers and solicitors whose names were on the prospectus. From this one can gauge how great or how small was the part taken by the general public in the famous rush for the shares of Metalite, Limited. Deduct the sums mentioned above, and make a generous allowance for the blocks of shares held by parties interested in the promotion, and it is not a considerable portion of the total allotment of £326,500 that was taken up by outsiders. Now that the truth is out, there must be a little uncomfortable feeling under the waistcoats of a few City and electrical gentlemen.

Of all people who hate publicity or inquiry, the administrators of municipal electricity undertakings are the ones strongest in their objection. We have had some instances of where they have declined to let local gas managers, in connection with the lighting of public establishments, make investigations for the purpose of putting in tenders competing with electricity tenders. There can only be one reason for this. We have known instances where municipal owners of electricity undertakings have absolutely declined to allow the local gas company to tender or make any demonstration in connection with a scheme to "improve" the public lighting. There can, of course, only be one reason for this. The Beckenham District Council would like to have outstanding matters between them and the Local Government Board settled by the particulars being sent to the Board in writing and therefore privately, and discussed with the officials behind closed doors at the offices of the Board. There can only be one reason for this. The matter arises in this way. The Council some time ago asked for a loan for electricity purposes; but, as is so commonly the case, pertinent particulars could not be obtained by the Inspector, and so the inquiry was adjourned. Of course, the ratepayers are interested in learning the nature of the replies given to the points raised by the Inspector. The Council are apparently just as interested in trying to prevent the ratepayers satisfying their curiosity; and so their proposal is to have the points settled privately. At the same time, the Council assures the Board that they have no objection to any inquiry that may be considered necessary. Then why suggest the backdoor method of supplying the particulars as to outstanding matters?

Drehschmidt's Mantle-Testing Machine.—In response to an inquiry made in regard to this apparatus, which was referred to in last week's issue (p. 285), it may be mentioned that an illustration of the arrangement was given in the course of an article by Dr. Bohm, on "Incandescent Mantles Made from Artificial Silk," which appeared in the "JOURNAL" for Oct. 22, 1906, p. 878.

Institute of Sanitary Engineers.—At a sessional meeting of the Institute last Tuesday, Mr. R. Horton gave a students' lecture on "Lighting." We learn from the Secretary (Mr. Nandy Hoskins) that on April 19 Mr. Gaster will deal with "The Hygienic Aspects of Illumination, and the Progress in Illuminating Engineering." The President (Mr. A. J. Martin, M.Inst.C.E.) delivered his Inaugural Address at the Caxton Hall, Westminster, last night.

Books Received.—"County Court Practice Made Easy, or Debt Collection Simplified," by A Solicitor; and "Key to Elementary Book-Keeping for Day and Evening Schools and Commercial Classes," by A. Munro, F.C.I.S. (London: Effingham Wilson.) "Die Strömung in Röhren," by Herr Blaess. (Munich: R. Olderbourg.) "Das Acetylen, seine Eigenschaften, seine Herstellung und Verwendung," by Professor Dr. J. H. Vogel. (Leipzig: Otto Spanier.) We hope to notice the two last-named works in early issues of the "JOURNAL."

Masonic.—An unequivocal success was the opinion expressed by many, and must have been felt by all, of the hundred and eighty guests at the "Ladies Banquet" of the Evening Star Lodge held at the Connaught Rooms, Freemasons' Hall, last Friday. In this way the W.M. (W. Bro. W. A. Surridge) brought almost to a close a very successful year of office, as his successor in the chair, Bro. Cyril Davis, will be installed next month. A handsome souvenir of the occasion was handed to each lady during the dinner; and subsequently the speech-making was strictly limited, so as not to interfere unduly with an excellent "Variety Concert."

Analyses of Municipal Gas Accounts.—We have received from Messrs. John Allan and Co. the "Gas World Analyses of Municipal Gas Accounts" for 1909-10. The accounts of 73 municipal gas authorities are analyzed, compared with 69 in the preceding issue; all the items of revenue and expenditure being worked out at per 1000 cubic feet of gas sold. The makes of gas range from 45 million cubic feet to upwards of 7545 millions per annum. To allow of easy comparison of one account with another, cardboard rules, either in blank to allow of figures being filled in, or with the figures of any particular undertaking in the series printed thereon, are supplied with the "Analyses." The book costs 10s. 6d. net.

PERSONAL.

Last Thursday and Friday, interesting presentations were made to Mr. GEORGE THORNTON ANDREWS, the Manager and Engineer of the Swansea Gas-Works, in view of his forthcoming marriage with Miss Florrie Barclay. On the Thursday afternoon, Mr. Charles Standish, supported by Mr. Oxenham and the other members of the clerical staff, presented Mr. Andrews, who was accompanied by Miss Barclay, with a beautiful silver epergne; and in making the presentation, Mr. Standish spoke of the respect and esteem in which the recipient was held by the staff, and the spontaneous manner in which the amount necessary for the epergne had been subscribed by everyone. In acknowledging the gift, Mr. Andrews said he thanked them very much on behalf of himself and his intended bride for their choice and very handsome present. Such a tangible mark of their generosity showed the good feeling which existed between the staff and himself. He did not forget that other members of his family had been the recipients of tokens of their esteem; and the presentation they had made to him would remind him of the cordial relations he hoped would always exist between the members of the staff and himself. Mr. Andrews and Miss Barclay subsequently received a deputation of workmen of the Company, headed by Mr. Dean (foreman) and Mr. Smalldon, who has been employed at the gas-works for over fifty years. Mr. Dean, on behalf of the Presentation Committee, in a graceful little speech, asked Mr. Andrews' acceptance of a beautiful marble and bronze clock and bronze ornaments. Other members of the deputation also made some appropriate observations, and referred to the friendly relations that existed between themselves and the recipient's father, the late Mr. Thornton Andrews. Mr. Andrews thanked the men for their kindness. Their gift, he said, was a magnificent one, which he could not too highly appreciate. The office staff and employees were afterwards regaled with light refreshments. On the Friday morning, in the Board-room, after the meeting of Directors had terminated, Mr. J. Glasbrook, the Chairman, on behalf of himself and his colleagues, presented Mr. Andrews with an elaborate oak and silver canteen of cutlery. In making the presentation, Mr. Glasbrook referred to Mr. Andrews' amiability and worth as an official, and said it was the sincere wish of the Directors that Mr. Andrews and Miss Barclay would be spared to enjoy every happiness in their married life. Mr. Andrews acknowledged the gift in a suitable speech. The marriage will take place to-morrow (Wednesday) at the Church of St. Peter and St. Paul, Black Notley, near Braintree, Essex.

OBITUARY.

The death occurred on the 29th ult., at the age of 55, of Mr. CHARLES ELLIS, the Outdoor Superintendent of the Yarmouth Gas Company. The health of the deceased began to fail about Christmas last; and he was removed to Norwich, where his illness terminated fatally. He had been for thirty-five years in the service of the Company, and was specially active in connection with the gas-stove and cookery exhibitions held from time to time in Yarmouth. He had a large circle of friends, by whom his death will be greatly regretted. It is rather singular that two of the long-service officers of the Company—Mr. Panchen, the former Secretary, whose death was recorded in the "JOURNAL" for the 17th ult., and Mr. Ellis—should have passed away practically within a few weeks of each other. The funeral, which took place at the Caistor Cemetery on Thursday, was attended by a large number of friends of the deceased; among the mourners being Mr. W. J. Carpenter, the Manager and Secretary, and members of the staff of the Company with which Mr. Ellis had been so long connected.

The Midland Junior Gas Engineering Association will meet next Saturday afternoon at the Birmingham Municipal Technical School, when a paper entitled "Practical Hints on Retort-Settings and Appliances Connected Therewith" will be read by Mr. T. Brooke, of Birmingham. A Coffee Meeting has been arranged to take place after the general meeting.

The London and Southern District Junior Gas Association will next Saturday afternoon visit the Stepney station of the Commercial Gas Company. The next meeting at the Westminster Technical Institute will be on Friday, the 24th inst., when Mr. J. G. Clark will read a paper entitled "Some Phenomena of the Electric Current," which will be illustrated by experiments. The annual dinner will take place on March 4, at the Cannon Street Hotel.

"Self-Instruction for Students in Gas Engineering."—We have received from the offices of the "Gas World" the fourth edition of the above-named work. It contains answers to questions based on the Ordinary Grade syllabus in "Gas Engineering" of the City and Guilds of London Institute; and in an appendix, answers are given to the questions set at the 1909 and 1910 examinations. These are followed by a reproduction of the paper on "Ammonia Recovery" read by Mr. W. H. Johns, the Superintendent of the Saltley Gas-Works, Birmingham, before the Midland Junior Gas Engineering Association in November last, and given at the time in the "JOURNAL." The letterpress throughout is fully illustrated. The price of the book is 3s. 6d. net.

THE CO-OPERATIVE PUBLICITY MOVEMENT.

AN APPEAL FOR ENERGETIC ACTION BY ALL PROGRESSIVE GAS MANAGEMENTS.

[From A CORRESPONDENT.]

UNLESS rumour be again a lying jade, there is serious reason to fear that the movement towards combined action in the British gas industry for the protection and the advancement of its interests may prove abortive for want of adequate support.

If this is a pessimistic view of the situation, well and good; but if it is a true one, then it is well that plain words should be spoken before it is too late. For it is no exaggeration to say the reputation of the gas industry as a whole for progressive enterprise is at stake. Are gas managers up and down the country willing to be regarded by their vigilant opponents as being supine and their undertakings as barnacled? Will they fail where their rivals have succeeded?

The Electricity Publicity Committee is not merely a "pious" aspiration; it is a living and active organism, plentifully endowed with funds—a body whose activities are becoming daily more evident in the Public Press, on the hoardings, and in the letter-boxes of our consumers; and, unless my information is sadly at fault, what we have seen and felt is nothing to what we shall see and feel before many months are out.

Now, to put the issue plainly, are the gas managers of this country in earnest in this matter, or are they not? We have been talking, more or less, about the need for action for the past three years and more—ever since the subject was mooted at the Dublin meeting of the Institution by Mr. F. W. Goodenough; and the air has been full of talk on the subject ever since last April. Is it to end in talk, or is there real driving power in the industry? Have we really, all of us, got beyond the "retort-house" stage, and realized the urgent and incessant need for scientific, combined, selling organization?

The business world at large resounds with discussions of selling methods. Numerous well-written and widely-read periodicals deal, month by month and week by week, with salesmanship in all its branches; classes are being held up and down the country for teaching the science of advertising and selling; in every trade the need of aggressive methods is recognized. Is the gas industry to lag behind the remainder of the commercial world?

"Oh!" says some one, "we fully recognize the need for enterprise, for advertising, and other plans for pushing sales. But we are doing all that already; we are satisfied with our own efforts. Why should we join the combined movement, and subscribe a large sum to a central fund?" The answer is that, first, no one undertaking, however large, can possibly secure for itself, by local individual effort, all the success that can be achieved by combined effort; and, second, that the local work can be rendered easier, cheaper, and more effective by the pooling not only of the money but the brains of the industry, and the securing with the money the best brains of the outside expert advertising profession for the advantage of one and all.

The Joint Committee for the gas industry, if constituted on a sound basis, would not only carry out a comprehensive scheme of high-class advertising in all descriptions of periodicals of wide circulation, but would be able to secure thereby—and because the subject of the utilization of gas is one of the most widespread interest, both domestic and commercial—editorial sympathy and co-operation. All this, with its consequent prevention of the appearance in the Press of inspired falsehoods concerning gas, would, by the continual process of "suggestion," which is so invaluable to the advertiser, create a foundation of great value on which to build the local salesmanship.

Such subjects as the hygienic aspect of gas lighting; the smoke abatement, drudgery-saving, and hygienic aspects of gas heating; the domestic economy and national efficiency aspects of gas cooking—can only be treated effectively and thoroughly upon broad general lines, and through such writers and speakers as only a central organization can secure.

For so diffused an industry as ours, co-operation in these matters is absolutely essential. Very few companies are big enough to support a commercial expert, an editorial staff, and an advertising manager; and not one is big enough to do it on the scale on which it should be done. The Gaslight and Coke Company have done something in this direction, with obvious advantage to themselves and not a little to us all; but they have only touched the fringe of the possibilities. The gas-fire business, which can only be effectively pushed by advertising, advertising, advertising—backed, of course, by scientific workmanship—is only as yet in its infancy. So also with the vast field of water-heating by gas and coke.

A great harvest awaits us if we are willing not merely to reap but to sow. But, if we fail to seize the opportunity that now presents itself, the vigilant, active, and powerful enemy which is already harassing our march, will reap the harvest which our indifference and folly have given over to him. Are the managers of this country willing to let this be the outcome of the publicity campaign? I believe not—when once they realize the position. But it is time they realized that the moment has arrived to act with energy and determination.

COMPETITIVE PRIZES OFFERED BY THE ITALIAN GAS SOCIETY.

It may be remembered that last year (as was noted in our columns at the time) the Italian Gas Society enlarged its scope by opening its doors to the organization of a then existing Italian Association of Water Engineers, and that the title of the Society became "Associazione Italiana delle Industrie Gas e Acqua"—the letters "A.I.G.A." being used to signify in short the combined representative Society of Gas and Water Engineers.

We have now just received some copies of the new regulations of the Society relating to the awards that are to be given to those sending papers or presenting novel apparatus to the Italian Association. The rules regulating the conditions for competing for these prizes are, in general, on similar lines to those in force for the analogous competitions organized by the Société Technique du Gaz en France; and as these latter are now pretty familiar to our readers, we need not go into any detail with regard to the former. Briefly, the competitions of the Italian Association are of two main divisions—ordinary and extraordinary. The ordinary division comprises awards annually to the most meritorious papers and to apparatus submitted by members to the yearly gathering. It is open only to those who are members of the Association. On the other hand, the competitions of the extraordinary division are thrown open to all, though power is reserved to limit them to members of the sister Societies. The controlling authority and examining committee of these competitions consists of the following: Sig. C. Pouchain, President of the Association, Sigg. Beria (Turin), Bonn (Verona), De Jongh (Rome), Gruss (Milan), Laeng (Brescia), Spreafico (Turin), and Maggioni (Modena); the last-named being the Secretary both of the Association and of the Competitions Committee. The prizes offered for this year are a first prize of lire 2000 (£80) and a gold medal; a second prize of lire 1000 (£40) and silver medal; and a third of lire 500 (£20) and bronze medal. Any essays or papers submitted for these prizes must be anonymous (arrangements being made to ascertain subsequently the authors), must be in the Italian language, and eight copies must be sent to the Secretary before June 30 next.

Although the choice of subject is left to each competitor, certain subjects, with special regard to the needs of the gas industry in Italy, will be given preferential treatment. These subjects are as follows:—

1. What are the most suitable retort-furnaces according to the size of works?
2. What is the best system of enriching gas?
3. Present state of manufacture and use of water gas, its advantages and drawbacks, and its adaptability to works of varying outputs.
4. If, and how, the gas industry in Italy can avail itself of national fuels.
5. Long distance gas distribution.
6. Modern systems and arrangements for purifying gas.
7. Tar and its use.
8. Poor-gas producers (in relation to the gas lighting industry).
9. Gas-turbines (an important subject, as its successful development would extend the use of illuminating gas for motive purposes).
10. Gas heating of houses—methods, examples, and practical information.

It will at once be seen that the list of suggested subjects covers a wide field; and in view of the large and extending relationships between British gas apparatus manufacturers and Italian gas companies, it may not be too much to expect to see some British gas engineer or representative a successful prize winner in this or subsequent competitions.

THE FUNCTIONS OF AN INSTITUTION.

By "Assoc.M.Inst.C.E."

In these days of a multitude of professional and other institutions, societies, associations, leagues, unions, and federations, each with its own sphere of interests and labours, each representing some section of human activity, each propagating or protecting some particular view or calling, each *pro*-this or *anti*-that, it may well be that the real functions of such organizations may be overlooked, and that one cannot see or use the wood for the trees. The danger, generally speaking, as it seems to us, of such a multiplication of bodies is that, instead of combining the efforts of many in one direction for a common object, as is no doubt the theory, it rather conduces, in actual practice, to a shelving of the individual member's responsibility, and in his delegating his duties to a chosen few. Thus, in place of a mass of workers actuated by a common cause, there arises a "Committee of Advisers," who consult and consider, occasionally report, and more rarely act.

Individual energy and enthusiasm are all but killed in the process of delegation. The average member sinks into a comfortable but slothful obscurity, pays his annual subscription with haunting doubts as to its utility, presents himself, half in holiday mood, at the one and only annual gathering, barely listens to the droning discussions of the hardy perennials, and eventually retires, unrefreshed and unenlightened, to the regular routine of his daily toil. True, his delegates, the Committee, may have, at infinite pains, presented before him half-a-dozen, may be, technical papers of varying merit; but, as likely as not, their reading was hurried, their discussion curtailed, and their interest limited. The matter of the papers could have been equally well offered to him in his study, and a carefully-considered discussion upon it have taken place through the Technical Press. But if this were the case, it might almost be said, the only evidence of life on the part of his technical representative body would be gone; for it apparently acts on the assumption that its members can hear but cannot read, and it has some reason for thinking that they are dumb. It therefore continues once a year to throw out a large quantity of technical fare, which is rapidly bolted, but not assimilated, in the course of three days, by some of its long-suffering members, who have made an effort to be present at the repast. The providers of the feast having, as may be thought, justified the chief object of their existence, retire from the public gaze to consider and prepare for the next annual bout. True, again, it no doubt is, that some among them are desirous of a more active, progressive, and profitable interval; but the point is that, on the part of the bulk of the members, there is a lukewarmness of interest, and an apathetic tolerance of what little is done or proposed, and, on the part of their representatives, spasmodic and ill-directed effort, with long and lethargic intervals.

The first and truest function, in my view, of an institution is that it should create and establish between its members a bond of sympathetic interest in their common professional life. Without this, although there may be the outward trappings of an incorporated being, there is no vitality. If an institution ceases to be in some form or other a personal friend and helper to each individual member, as far as that member is concerned the institution is useless and dead. If the member does not draw from his membership at least a feeling of professional kinship and *camaraderie*, then there is something wrong either with him or his corporate life. If there is no brotherhood, there is nothing. The ways of inculcating this essential spirit are many and various; and each institution must work out for itself the best methods available for its own particular requirements. A good illustration of this comes to hand at the present moment in the extending scope of the work of the Société Technique du Gaz, who have decided to appoint five separate Sub-Committees, dealing with different branches of gas-works' management; the object of all being to bring the members into closer co-operation, to give the inquirer information, to offer advice in technical difficulty, and to encourage the managers of smaller gas-works to make their experiences known.* Throughout the presidential statement of M. Marquisan, there runs the note of sympathy and fraternal help—more apparent, perhaps, in the phraseology of the original than in the bald translation. But the right spirit is there, and the year-round continuity of the Society's work is there. Many would like to see something of the same manifestation in our own representative associations. Until it arises, the gas engineering profession will never reach that status and that high level in public estimation that it clearly deserves.

WATER BILLS FOR 1911.

[Second Article.]

In the last number of the "Journal," the Bills promoted by Water Companies for the present session were noticed. We deal to-day with some of the measures introduced by Local Authorities containing proposals in reference to water supply.

As already mentioned [see *ante*, p. 152], the Bedwellty District Council are seeking authority to purchase the undertaking of the New Tredegar Gas and Water Company, Limited, and to supply gas and water within the urban district. The portion of their Bill which relates to the supply of gas has been fully dealt with; so that it now only remains to refer to the water clauses. These are to apply to the existing water-works of the Council, and also to those which they purpose acquiring. The limits of supply are to be the district and a defined part of the Rhymney Valley within the parish of Gelligaer. The rates to be charged range from 3d. per week, where the rateable value of the premises supplied does not exceed £7 10s., up to 6 per cent. per annum where it is over £80, with an additional sum not exceeding 5s. for every closet beyond the first, 10s. for every fixed bath holding not more than 50 gallons, and such sum as the Council may think fit for larger ones. The charge for water supplied by measure is not to exceed 2s. per 1000 gallons, with a minimum of not more than 10s. in any quarter. Authority is required for the sale of water in bulk and by measure, to make bye-laws and provisions for detecting and preventing waste, to impose penalties for injuring meters, and to supply meters and fittings. The water is to be as pure as, "having regard to the source and nature of the supply, circumstances will admit;" and it need not be delivered at a greater height that can be reached by gravitation from the works, or be constantly laid on. The other powers required relate to the purchase and holding of lands for water purposes and the protection of the works, and the purchase of water in bulk from any authority, company, or person empowered to sell it. The Council are not to construct works for taking or intercepting water from any lands acquired by them unless they are specified either in the Act

* Particulars of the suggested extension of the scope of the French Society appear elsewhere to-day, p. 382.—Ed., J. G. L.

applied for or in some other. [*Parliamentary Agents: Messrs. Baker and Co.*]

The Bill promoted by the Blackburn Corporation is to sanction and confirm the construction of certain works, authorize others, confer further powers with respect to the supply of water, and empower the Corporation to raise more money. The works for which sanction is required consist of a reservoir already commenced, in the county borough of Blackburn; and those proposed to be constructed comprise a reservoir partly in Rishton and partly in Wilpshire, in the rural district of Blackburn, four conduits or pipe-lines, a culvert, and alterations of a road and footpaths. Ten years are required for the completion of these works, and the Corporation apply for an extension to twenty years from the passing of the Bill of the time limited by their Act of 1898 for the construction of the Brennand and Whitendale reservoirs and other works authorized by the Act of 1877. Borrowing powers to the extent of £75,500 are required for the purchase of lands and the carrying out of the works authorized by the Bill; to be repaid within sixty years. [*Parliamentary Agents: Messrs. Tahourdin and Birds.*]

In a General Powers Bill promoted by the Gloucester Corporation, authority is sought for the construction of new water-works, consisting of a well and pumping-station in the parish of Pauntley, an aqueduct or pipe-line from it to a junction with the outlet-pipe from the more northerly of the two reservoirs of the Corporation at Madams Wood, and an approach road. Five years are required for the completion of these works. If by pumping at the new station the Corporation cause a diminution of the supply in any private well within half-a-mile, they undertake, on being requested in writing to do so, to afford to the owner a supply equal to the diminution, at such rate (if any) that the total cost to him of obtaining his full supply shall be the same after as before the construction of the station. Instead of making good the supply, the Corporation may deepen the affected well. In case of failure to provide the quantity of water lacking, they will make compensation. Further, if the pumping at the new station causes any material diminution in the flow of the River Leadon, they undertake to compensate parties interested in the river, including those having mills or fishing rights. Authority is required to borrow £27,000 for the works specified, to be repaid in sixty years. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

Another General Powers Bill is that promoted by the Halifax Corporation; and by it they seek authority (*inter alia*) to construct works and make better provision with regard to their water undertaking. They wish to construct a line or lines of pipes in the parish of Wadsworth, in the West Riding of York, and a wall in extension of the existing centre wall of the dam of the Walshaw Dean lower reservoir. A clause in the Bill sets forth in detail what are not to be considered as "domestic" purposes; and the supply for them is to be furnished either by meter or according to a scale of charges for the time being in force. The Corporation require power to alter the date for the payment of water-rates, so as to make it coincide with the date for paying the borough or general district rate; also to compound rates with owners, and allow to consumers discounts not exceeding 5 per cent. for prompt payment. The Corporation ask for large borrowing powers in connection with their water undertaking—the principal amounts being £53,516 for repayment of the sum expended upon the construction of the Walshaw Dean reservoirs and £23,000 for their completion. They ask for fifty years in which to repay these sums. [*Parliamentary Agents: Messrs. Lewin, Gregory, and Anderson.*]

The Bill of the Corporation of Harrogate is for the purpose of obtaining an extension by three years from Aug. 9, 1911, of the time specified in their Act of 1901 for the completion of the reservoir thereby authorized. It is proposed to alter the rates for the supply of water as follows: Where the rateable value of the premises supplied does not exceed £5, the charge is to be 8s. 8d.; where it is more than £5, the rate is not to exceed 10 per cent. of the rateable value. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

The Hastings Corporation have promoted a Bill to obtain further power with respect to the water supply of the borough, and also authority for the construction of additional works and the purchase of the lands on which the existing works have been constructed. The lands are situated in the parishes of Catsfield, Crowhurst, Bexhill, and Hastings; and the proposed works comprise three pumping-stations, a service reservoir, and six conduits or pipe-lines. The Corporation require a period of ten years within which to complete these works, and authority to raise £27,995 for the purchase of the lands upon which the existing pumping-stations stand, to be repaid within sixty years. Where water is supplied by measure, the charge is not to exceed 2s. per 1000 gallons. The other provisions of the Bill do not call for any notice. [*Parliamentary Agents: W. & W. M. Bell.*]

In a General Powers Bill promoted by the Hornsea Urban District Council, authority is sought to make better provision in regard to the supply of water, particularly with respect to the charges for trade uses and by measure. In the case of persons requiring water for other purposes than consumption by their own families, for baths or water-closets in or attached to any building not being a private dwelling-house, or for any trade or business whatsoever, the supply may be furnished by meter or otherwise, in accordance with any scale of charges which the Council may draw up, and which is for the time being in force. In the case of stables or premises in which horses, carriages, or motor-cars are kept for private use, and which are occupied and rated along with any private dwelling-house, the water supplied for domestic purposes may be used if the water-rate is assessed upon the annual rack-rent or value of the house including the stables. If, however, a hose-pipe or other similar appliance is used, the Council may make such additional charge therefor as may be prescribed by the scale of charges for a tube for watering gardens. The price to be charged for a supply of water by measure within the limits of the Council is not to exceed 3s. per 1000 gallons; but the Council are not to be compelled to supply by meter for less than 5s. in any quarter. They wish to be empowered to make bye-laws to prevent waste. [*Parliamentary Agents: Messrs. Baker and Co.*]

The Ipswich Corporation are applying for authority to construct a pumping-station, and extend their limits so as to include five parishes in the rural district of Samford, four in the rural district of Bosmere and Claydon, and seven in the rural district of Woodbridge, all in the county of Suffolk. The rates to be charged range from 8s. 8d. per annum where the gross estimated rental of the premises supplied does not exceed £5, up to 8 per cent. per annum where it is above £100. The pumping-station which it is proposed to construct will be situated in the parish of Whitton, in the rural district of Bosmere and Claydon, and there is to be a conduit or pipe-line connecting it with the existing reservoir of the Corporation in the borough of Ipswich. Five years are required for the completion of the works. The Corporation apply for authority to purchase and hold lands and exercise powers for the protection of their water and water-works, and to make bye-laws for the prevention of pollution. The price to be charged for water supplied by measure is not to exceed 2s. 6d. per 1000 gallons. Power is required to borrow £21,000 for the purchase of land in connection with the construction of the works specified, and £5000 for new mains, extensions, and other purposes, for both of which sums a period of fifty years is required for repayment. [*Agents: Messrs. Sharpe, Pritchard, and Co.*]

Application is being made by the Kingston-upon-Hull Corporation for authority (*inter alia*) to construct water-works and extend their limits of supply. The works comprise a pumping-station at Dunswell, in the urban district of Cottingham; a water-tower in the parish of Marton, in the rural district of Skirlaugh; another in the parish of Rimswell, in the rural district of Patrington; and seven conduits or pipe-lines. Seven years are required for the completion of these works. The limits of supply, should the Bill pass, will include the rural districts of Patrington and Skirlaugh; and the rates chargeable in the new limits for water used for domestic purposes will range from 8s. 8d. per annum where the gross estimated rental of the premises supplied does not exceed £5, up to 8 per cent. per annum where it is above £100. The charge for water supplied by measure is not to exceed 2s. per 1000 gallons. Provision is made for the supply of water in bulk to the Corporation of Hedon and the Urban District Councils of Hornsea and Withernsea. The promoters also require power to borrow £73,000 for the purchase of lands in connection with the construction of the works specified, and £47,000 for new mains, extensions, and other purposes; and they ask for fifty years in which to repay these amounts. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

The Corporation of Merthyr Tydfil are applying for authority to construct an impounding reservoir in the parishes of Llanfigan, Llanddetty, and Vaynor, in the county of Brecknock. It will be formed by means of a dam across the River Taf Fechan; and in connection with it there will be four pipe-lines and three road diversions. Ten years are required for the completion of these works. Until the reservoir has been constructed, and the Corporation are drawing their water from it, they are to be entitled, unless the existing Pentwyn reservoir shall be rendered effectually water-tight, to draw from the river, at any point below the dam of the Pentwyn reservoir and above the site of the dam of the new reservoir, a quantity of water not exceeding 2 million gallons in any day. The powers thus conferred upon the Corporation are not to be exercised in such a manner as to interfere with the performance of their obligations with respect to the discharge of compensation water. When the reservoir is completed, and the Corporation intercept water by means of it, they are to send into the river, at a point not more than 300 yards below the foot of the dam, not less than 6,835,000 gallons of water in a continuous flow every 24 hours. Authority is required to borrow £399,972 for the purchase of land in connection with the water-works and road diversions specified, to be repaid in sixty years. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

An Effective Gas Stand.—The Gaslight and Coke Company's "Co-Partners Magazine" for the current month, of which we have received a copy from the Secretary (Mr. H. Rayner), contains an illustration of the Company's pretty, simple, and effective stand at the recent Suburban Homes Exhibition in the King's Hall, Hackney. It was designed and made at the Mare Street district office, under the direction of Mr. R. Willsmer, the Inspector-in-Charge. It was divided into four sections; or rather, as it stood upon an "island" site, it had four distinct aspects. The sections represented an office, a drawing-room, a kitchen, and a bath-room. All the piping, with the necessary control-valves, &c., was hidden inside the central block, which formed the background of every face of the stall. The stand cost practically nothing, as it was furnished entirely out of stock; and at the close of the exhibition every article was returned to the store—even the mantles being preserved and used in the shop lighting. Not a chimney, nor a globe—not even a mantle—was broken or lost.

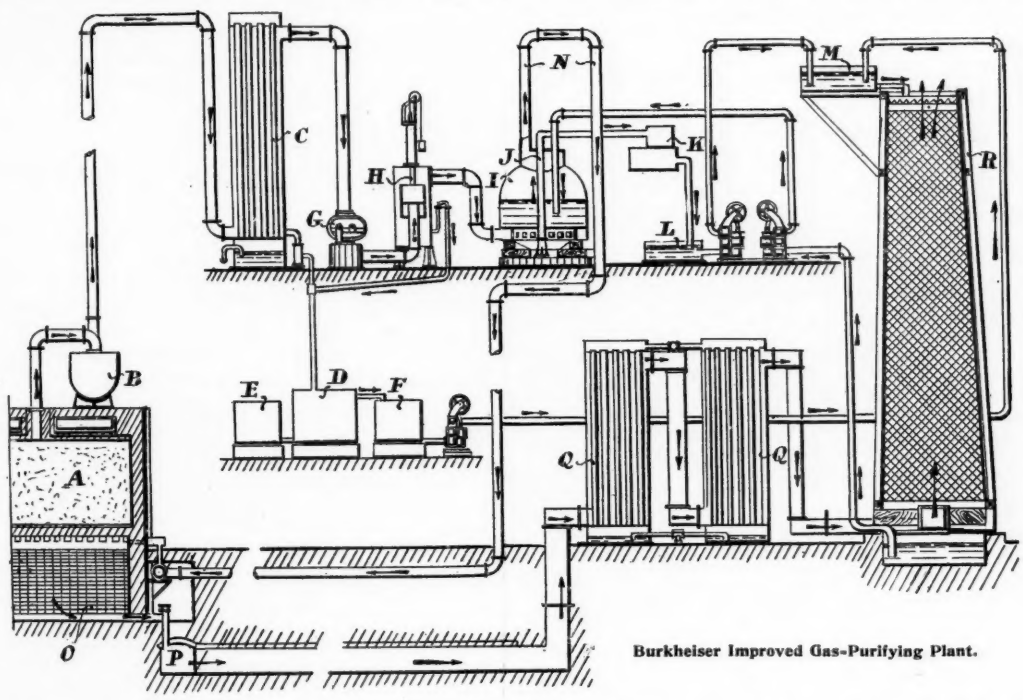
THE BURKHEISER GAS-PURIFYING PROCESS.

A Further Improvement.

In previous issues of the "Journal," several references have been made to the process of Herr Karl Burkheiser, of Aix-la-Chapelle, for the purification of gas and the simultaneous production of sulphate of ammonia. An article descriptive of the process, and abstracts of the English specifications, appeared in Vol. CVIII. (pp. 311, 326, and 477); and in the number for October last an indication was given of some amendments made by the patentee. Another addition has been made to the patent; and the following particulars are taken from the French specification, which has lately been published.

The principle of the earlier patent, which consists in setting up a reaction between the ammonia of the gas, after oxidation, and the sulphides in the coal or the gas—thus directly producing sulphite or sulphate of ammonia—is, as regards the subsequent employment of the gases, associated in most cases with the separate oxidation of the sulphuretted hydrogen, without the simultaneous influence of the other constituents of the gas. While this separate treatment of the sulphuretted hydrogen can be effected by conveying the gases over a mass transmitting oxygen, in many works a natural oxidation process is available by the combustion, on the spot, of the gas containing the sulphuretted hydrogen. In coke-works, for example, where the resulting gas is burnt partly in the furnace and partly under the steam-boilers, sulphurous acid is contained in the waste heat in proportion to the initial percentage of H_2S. Even though perfect oxidation of the sulphuretted hydrogen is effected by transmission of oxygen, special devices and a perfectly-defined method of operating them are necessary. The idea of likewise bringing into reaction with the ammonia of the gases the sulphurous acid produced in normal working is difficult of realization, because the gaseous acid is very greatly diluted in the combustion gases, which occupy approximately ten times the space of the original gas. Leaving out of consideration the fact that a mixture of the ammoniacal gases resulting from distillation with the combustion gases is not generally practicable, it is precisely this great dilution which would operate against a mixing of the gases of combustion with the ammoniacal vapours expelled from a distilling apparatus. The ammonium sulphite would also separate in the form of a mist which would be extremely difficult to condense.

The patentee claims that these inconveniences are avoided by the present invention, owing to the fact that the combustion gases containing sulphurous acid, in continual exchange with the ammoniacal gases resulting from distillation, are brought into contact with a like liquid employed for washing. This liquid consequently forms, on the one hand, an intermediary for the reaction of the two substances which are given up, and thus economizes the mixture of these substances; while, on the other hand, the liquid employed for washing is, with the absorption of ammonia, constantly again rendered neutral or slightly alkaline, so that, owing to its greater avidity for acid, it easily absorbs, notwithstanding its great dilution, the sulphurous acid from the gases. The union of the acid absorbed in one phase of the work by the ammonia entering into the second phase in a salt, which always presents itself in a state



Burkheiser Improved Gas-Purifying Plant.

of equilibrium, continually regenerates the liquid utilized for washing. This continuous regeneration is of the greatest importance for the practical realization of the patentee's object.

The accompanying illustration, which is given by way of example, represents a section of plant suitable for the application of the process.

The gases produced in the distillation chamber A, and collected in the receptacle B' are cooled in the refrigerator C. The products of condensation enter the separator D, where, according to their density, they divide into tar and ammoniacal liquor—the former passing into the tar-well E, and the latter into the tank F. The gas is then driven by the aspirator G into the tar-separator H, which, as shown, is in connection with D, and then flows, perfectly free from tar, into the saturation-tank I, which is filled with acid lye. The sulphate of ammonia which forms here is removed by the ejector J, and dried in the centrifugal apparatus K. The alkaline mother-lye flows into the receptacle L, and thence into the tank M. The gases return through the pipe N to the combustion chamber, to be employed for heating. The waste heat from the radiator O passes into the flue P, and is conveyed, at a suitable temperature, with the combustion gases resulting from part of the gas burnt under the steam-boilers, into the coolers Q, and then passes through the tower R, where it is washed by the liquid coming from the tank M. The gas liquor from the tank F is also conveyed to the liquid accumulating in M. It may, however, be pumped in the ordinary way into a still, and the waste fumes be mixed with the distillation gases. The lye in the tank M having to be alkaline, the addition of the gas liquor has no effect; nor is dilution of the lye of any consequence at this point.

The following are the operations connected with the process: The sulphurous acid produced by the combustion of the sulphuretted hydrogen in the gases is in a very dilute state in their products of combustion—chiefly carbonic acid, aqueous vapour, and nitrogen. By utilizing the lye, rendered alkaline in the saturator I by the ammonia of the gas, for spraying the washer R, and the lye acidified again in that vessel, being conveyed back into the saturator, the washing of the sulphurous acid is effected, notwithstanding the gas which accompanies it, and, moreover, facilitates the reaction with the ammonia without contact of the gases themselves. The liquid employed for washing, in addition to favouring the reaction of the ammonia and acid, and determining the place for obtaining the salt, may also influence the nature of the latter, whether formed of—

$$\left.\begin{matrix}NH_4\\NH_4\end{matrix}\right\}SO_3 \quad \text{or} \quad \left.\begin{matrix}NH_4\\H_4\end{matrix}\right\}SO_3$$

The new process has a special value for this conversion into a salt. With the usual production of ammonia, the water necessary for the formation of the salt, as well as a determined quantity of diluting water, is, as is well known, introduced with the acid in the process. But as additional quantities of water, such as that for washing in the centrifugal drier, are also met with in normal working, care must be taken that the non-utilized water is continually discharged, as otherwise the salt formed will be dissolved. This object is attained by evaporation when working above the normal boiling-point of water, and by superheating the gases when working below it. The acid being introduced in this process gaseous, and consequently perfectly free from water, and the liquid serving for washing being always employed again, the quantity of additional water can easily be estimated, so as to correspond with that of

the water employed in the process. Thus, without special precautions, a fixed salt is directly obtained without there being any limit as regards the favourable temperature for the separation of tar. Another advantage of the process is that the combustion gases are freed from sulphurous acid, which is so noxious to plants, even when it is greatly diluted. Whereas hitherto an outside chimney has been necessary to ensure its distribution over as large a quantity of air as possible, only a simple fan is now necessary. The process therefore appears to be applicable wherever products of combustion containing any sulphurous acid have to be disposed of.

The patentee says this addition to his patent comprises a process for the production of ammonium sulphite or sulphate produced by gas, and is characterized by the fact that the combustion gases containing sulphurous acid are, in the constant exchange with ammoniacal gases resulting from distillation, brought into contact with a like liquid for washing. This liquid, owing to its alkalinity due to the absorption of ammonia in one of the phases of working, and its continual regeneration in the process of the cycle, absorbs the sulphurous acid with greater avidity. It also comprises a process suitable for coke-works, where the gases containing sulphuretted hydrogen are utilized partly to heat furnaces and partly for steam-boilers. The gases are cooled, freed from tar, and washed upon ammonia with a lye which flows in a constant cycle between the saturator and a washer through which waste heat passes from the furnaces and boilers. The combustion gases are subjected to a limited cooling, not below their freezing-point, so that they may vaporize the water of the liquid employed for washing, even with the use of relatively large additional quantities, owing to their excessive heat and power to absorb steam; the lye existing in the saturator preserving the requisite density so as to obtain the salt immediately.

THE "STANDARD" CENTRIFUGAL GAS-WASHER.

Installation at the Salisbury Gas-Works.

Early in the past year, the attention of the Directors of the Salisbury Gas Company and their Engineer and Manager (Mr. Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S.) was directed to the capacity of their liquid purifying plant which was put down about twenty years ago to deal with a maximum production of 300,000 cubic feet of gas per day. So long as the make did not exceed 400,000 cubic feet, there was no difficulty in maintaining a clean ammonia test at the inlet of the purifiers; but with a daily make of 500,000 cubic feet or more the result was different. The position presented some difficulties, as no addition could be made to the non-mechanical washer, but little space was available, and full control over the strength of the liquor was desirable. Eventually, attention was directed to the "Standard" centrifugal washer of Messrs. Kirkham, Hulett, and Chandler, Limited, which offered the prospect of meeting the requirements more effectively than a tower scrubber, which it was at first decided to put up, as with it the strength of the liquor would be under complete control, and the cost appreciably less. The washer, it may be remembered, was described in the paper read by Mr. W. H. Johns, the Superintendent of the Saltley Gas-Works of the Birmingham Corporation, before the Midland Junior Gas Association last November, and was illustrated in Vol. CXII. of the "Journal," p. 491. This diagram was reproduced in the issue of the "Chemical Trade Journal" for the 28th ult., in connection with an account of the installation and working of the appliance at Salisbury, from which the particulars here given have been taken.

The washer consists of a vertical cylindrical cast-iron vessel—in this instance 17 feet high and 3 feet diameter—mounted on a pedestal, divided into eight equal-sized chambers, and traversed by a vertical shaft to which are attached spraying devices for lifting and spraying the washing liquid, and bringing it into intimate contact with the gas. The devices consist of specially designed trays having perforated rims and bent tubes, four in number, depending from their under sides. The sizes of the perforations are varied according to the nature of the work to be done. The trays are made in halves to facilitate removal for cleaning. The shaft and trays are caused to revolve at a speed of 120 revolutions per minute, by means of a gas-engine and driving-strap engaging with a pulley in the pedestal. As the devices revolve, the liquid is driven up the bent tubes and into the trays, and is thrown through the perforated rims with sufficient force to traverse the gas space, and dash with some violence against the sides of the vessel, rebounding from them and again coming in contact with the gas. The gas enters the lowest washing chamber, passes through the spray to the central opening leading to the second chamber, through the spray to the third chamber, and so on till it reaches the outlet on the top. The washing liquid is admitted at the top chamber, and passes down from chamber to chamber till it finally reaches the overflow at the bottom. When gas is turned into the apparatus, the level of the liquid in each chamber is slightly lowered; but a sufficient depth is maintained to ensure efficient spraying. The supply is regulated according to the strength of liquor desired at the outlet; but this does not affect the action in any way. The spraying effect is maintained quite as efficiently if the liquor supply stops altogether as with a continuous supply.

The washer at Salisbury was completed and put to work at the end of October. There was no hitch or delay in starting, and it is stated that it has worked satisfactorily up to the present time, running smoothly and quietly. The patentees claim that the levels of the liquid are maintained in all the chambers, and that the spray is equally effective at all parts of the circumference. There is no lipping at one side only. The central gas and liquor passages secure thorough distribution of gas, and prevent premature overflow of the liquor. Any desired strength of liquor can be obtained, and there is no risk of choking-up. These advantages are, it is said, all realized in practice. Moreover, the apparatus does not give back-pressure, and occupies less ground area than a tower scrubber of like capacity with pump and overflow.

The rate of supply to, and the quantity of liquid passed per 12 hours by, the washer is ascertained by gauging the overhead tank, which contains 7 gallons per inch of depth. The temperature of the liquid is exactly the same as that of the atmosphere, as also is that of the flow-off and of the outlet gas. No attempt has been made in the way of completely extracting the whole of the ammonia, because a Cockey five-chamber washer of the horizontal pattern (part of the original plant) is available for the purpose; but attention has been directed towards getting up a strong liquor at the outlet, especially with regard to the removal of carbonic acid. At a later period it is proposed to give more attention to the capabilities of the apparatus as a decarbonizer when supplied with ammoniacal liquor. With clean water admitted at the top at the rate of 3¾ gallons per ton of coal carbonized, and a make of 550,000 to 600,000 cubic feet of gas per 24 hours, it was found that 90 per cent. of the ammonia present in the gas at the inlet was retained by the water, which passed off as 16-oz. liquor, and the sulphuretted hydrogen and carbonic acid were respectively reduced to the extent of 10 per cent., which was a very acceptable assistance to the purifying-house. The remaining 10 per cent. of ammonia is extracted in the Cockey washer already mentioned. The centrifugal washer extracts a considerable quantity of naphthalene; and the patentees claim that this impurity can be practically entirely eliminated by using a suitable solvent in the last or top chamber—the water being in this case run into the second chamber.

THE "AUTOMATON" LAMPLIGHTER.

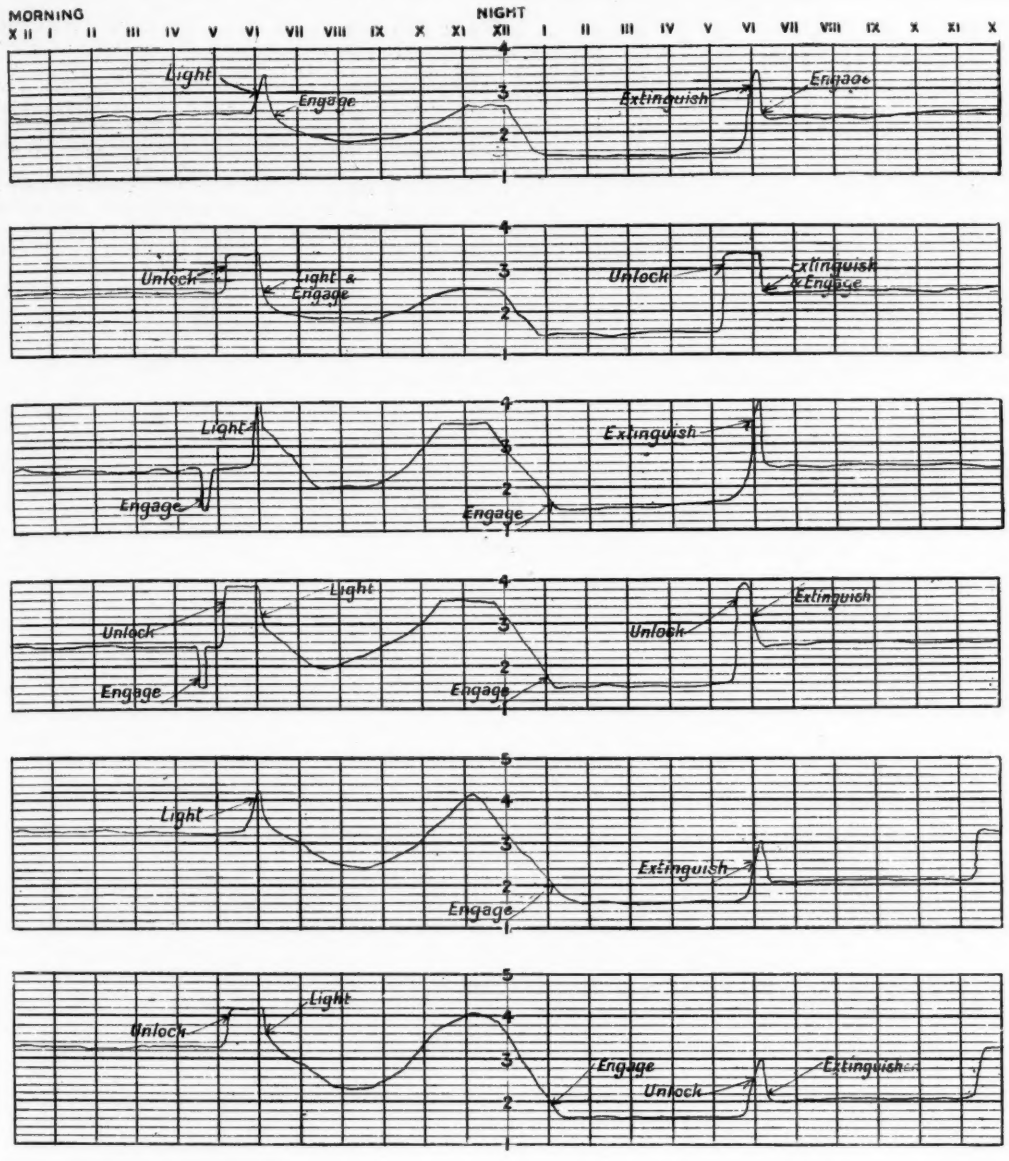
In October last, an article, on "Automatic Street Lamplighting," appeared in our columns. This evoked in subsequent issues an interesting correspondence from the inventors of various devices for lighting street-lamps. Among others, there was a letter dealing briefly with the "Automaton" pressure lamplighter, in which a promise was made to give at a later date particulars of how the various pressure conditions are met by this instrument.

For those of our readers who have not hitherto studied the question, we may give a brief description of the apparatus. The "Automaton" is small and compact, and can be readily fixed in a few moments on any lamp having upright or inverted burners. An illustration showing the device as fitted to a street lantern was given in the issue of the "Journal" for May 3 last, p. 306. The apparatus used consists of a simple clock-motor designed to directly turn the plug of the gas-tap, which is so constructed that the burner and pilot flames are alternately lit and extinguished by each movement of the mechanism. Each flame is instantly lit, or instantly extinguished. An interval is allowed, however—varying, as may be desired, from a quarter of a minute to one-and-a-quarter minutes—while the mechanism is operating, during which both flames are lit. This ensures that the gas will have ample time to pass to either flame, before the other one is extinguished.

The pressure of the gas extends a diaphragm, which presses against the first trigger plate, which in turn releases a locking lever. Weights are placed on the two trigger plate levers (the second trigger plate being operated by the first one) which prevent the release of the locking lever until a definite pressure is reached. A cam is attached to the arbor of the second wheel of the clock-motor, to turn the plug of the tap; the arm of this second trigger plate resting on the cam. In the bottom of the first trigger plate is an adjustable screw pin, which engages with a pin fixed on the worm screw. The object of this is to enable the gas to be lit or extinguished on a fall, instead of on a rise, of pressure.

It must be remembered that the diaphragm is always in a state of extension, caused by the gas, and is always pressing against the trigger plate; and, equally, the weighted levers cause the trigger plate to press against the diaphragm. When the pressure on the diaphragm becomes greater than the weights on the trigger plate levers, the mechanism is released; but it is automatically locked as soon as the plug of the tap is turned through an angle of 90°.

One advantage claimed for the "Automaton" is the mechanical precision with which each operation is carried out. Friction is reduced to a minimum, and is practically non-existent; and, consequently, the operation of the mechanism is not affected by the vibration caused by the wind or street traffic. It is not affected either by any quick or slow rise of pressure as such; but it immediately responds when the pressure reaches the point at which it is adjusted to work. The apparatus may be adjusted to operate on a rise of pressure or on a fall; or it will light on a fall of pressure, and extinguish on a rise of pressure. It will also light and extinguish at the same pressure. It will light at a high pressure, and



extinguish at a low pressure; or it will light at a low pressure, and extinguish at a high pressure.

The following explanatory notes will be of assistance in understanding the working of the apparatus:—

"Range" means the difference between the engaging and the operating pressures.

"Unlocks" means lifting the locking lever, but preventing the working of the mechanism by the interposition of No. 9 pin—the adjustable pin in the bottom of the trigger plate.

"Engaged" means that the pivoted pawl which is used to lift the locking lever returns (when the pressure is sufficiently lowered) to a position in which it can again act.

"Finishes the Stroke" means that when in the operation of lighting, one of the weights is lifted off, the diaphragm then interposes pin No. 9, which stops the mechanism. The withdrawal of the pin by the reduction of the pressure, permits the mechanism to "finish the stroke."

The simplest cam is No. 1, which is a plain disc, having a pin which engages with a pin on the gas-plug. As the cam is revolved by the mechanism, it takes the gas-plug with it. With this cam, the lamps are lit and extinguished on an increase of pressure, and at the same pressure, the mechanism becomes engaged on a reduction of pressure of ½ inch—the range being from 4-10ths to 5-10ths, and is caused chiefly by the lifting of the locking lever. This movement is shown on Pressure Chart No. 1. This cam is used when there is an ample margin of pressure.

Where the margin of pressure is somewhat restricted, and the engineer wishes to raise his pressure on a dull evening before lighting time, without operating the lamps, No. 9 pin is used. The lighting and extinguishing are then done on a fall of pressure, as illustrated in Chart No. 2. It may be mentioned that the range between unlocking and lighting, and unlocking and extinguishing, is adjustable—it may be anything from 1-10th to 10-10ths or more, as desired.

Where the surplus pressure above working requirements is limited, and the consumption considerable, and where morning and day pressures are just about the same, with a moderate evening, and lower midnight pressures, then a No. 2 cam is used. It is similar to No. 1 cam, but has a ridge round the edge.

In lighting or extinguishing the lamps, the weights on both trigger-plate levers have to be lifted. When a reduction of pressure is made, the arm of No. 2 trigger plate rests on the ridge of the cam—leaving one weight only pressing against the diaphragm. Hence, before the mechanism becomes engaged, a considerable reduction of pressure has to be made. The extent of the range is increased by taking weight off No. 1 lever, and putting on No. 2 lever; or decreased, by reversing this process.

The action of this cam is shown on Chart No. 3, while the action of the same cam in conjunction with No. 9 pin is shown on Chart No. 4. It will be observed that on these charts the pressure rises, after the evening consumption is over, to the same height as the operating pressure; but as the engaging point is set below the consumption level, this rise does not affect the mechanism.

No. 3 cam has two peaks, instead of a ridge, with the pin that engages the plug of the tap placed behind one of the peaks. It is used where the morning pressure is much lower than the evening pressure. The lamps are lit with a high pressure and extinguished at a low pressure. This is shown on Chart No. 5. This cam, working in conjunction with No. 9 pin, is shown on Chart No. 6.

No. 4 cam is similar to No. 3 cam, only that the pin is placed between the peaks, which causes the extinguishing to take place at a higher pressure than the lighting, and would be used under (for example) the following conditions: A gas-works has an extensive territory, a considerable portion of which is low-lying, where is also situated the gas-works. Another extensive district is on a level of over 200 feet above the lower area. In both districts there is an extensive evening consumption; while in the lower level there is an extensive breakfast consumption, which is absent in the higher district.

The pressure is put up at lighting time, which takes place at 52-10ths; the mechanism being also engaged at this point. At 6 o'clock next morning the pressure reaches 55-10ths without operating the lighter, because it is set to extinguish at 6 inches,

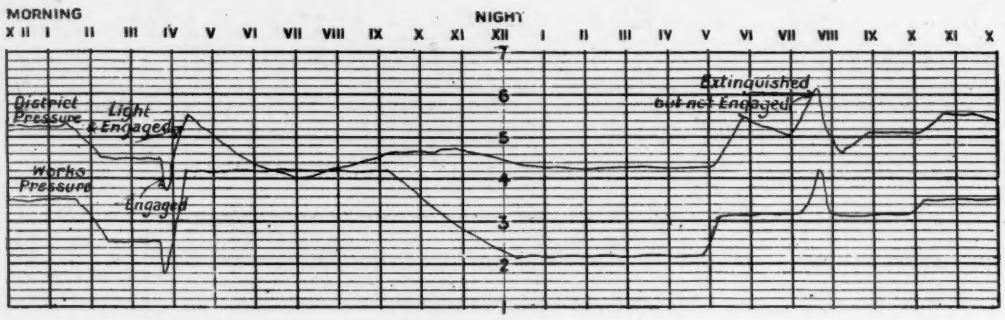

MORNING
NIGHT
X II I II III IV V VI VII VIII IX X XI XII I II III IV V VI VII VIII IX X XI X
District Pressure
Light & Engaged
Works Pressure
Engaged
Extinguished but not Engaged

CHART No. 7.

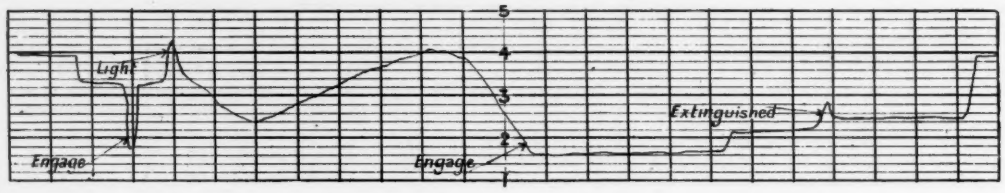


CHART No. 8.

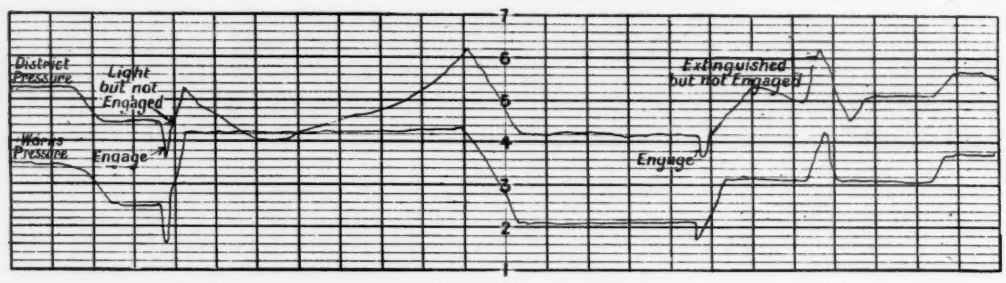


CHART No. 9.

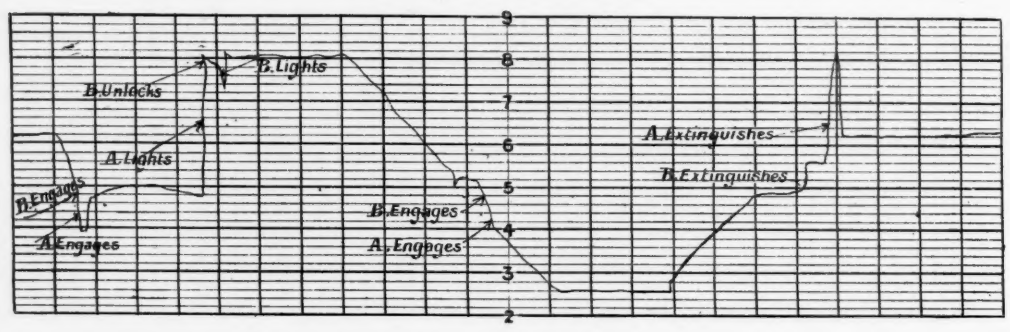


CHART No. 10.

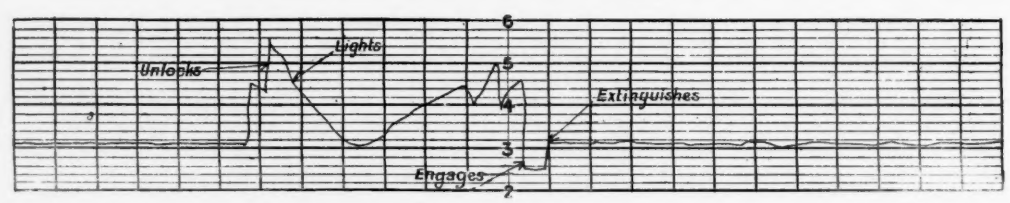


CHART No. 11.

and when it is extinguished it is not engaged. Thus a subsequent rise to 56-10ths at 11 a.m. does not affect it, because the mechanism is not engaged until just before lighting time by lowering the pressure to 4 inches.

The increased range from 4 inches to 52-10ths is obtained by weighting the locking lever. The action of this cam is shown on Chart No. 7. No. 9 pin may be used with the above cam.

No. 5 cam is similar to No. 3 cam, only that there is a ridge between the peaks—the object being to prevent the mechanism being engaged at extinguishing point. Its operation is shown on Chart No. 8. The rise at lunch time, although as high as the lighting point, does not affect it.

No. 6 cam is the same as No. 5 cam, only that the pin is between the peaks. It is different in its action to that of No. 4 cam to the extent that the mechanism is not engaged when the lighting is effected. This is shown in Chart No. 9. It is rendered necessary by the late evening consumption in the lower district, which prevents the pressure at the works being lowered until 11 p.m., instead of 9 p.m., and allows the pressure to bank-up in the higher district. Charts Nos. 7 and 9 are supposed to apply to the same districts. No. 9 pin is not used with Nos. 5 and 6 cams.

No. 7 cam, which has two high and two low peaks, will meet an entirely different set of conditions, as shown in Chart No. 10. A gas company has a large territory in which there are several municipalities, one of which (marked "A" on chart) has its lamps lit at sunset and extinguished at sunrise. The other municipalities (marked "B" on chart) have their lamps lit half-an-hour after sunset, and extinguished half-an-hour before sunrise. The "A" lamps are operated on a rise of pressure, and engaged at a lower pressure. If a second rise of pressure is given to light the "B" lamps, it would extinguish the "A" lamps.

To overcome this difficulty, the "B" lamps are lit on a fall of pressure, and are extinguished on a rise of pressure (which is, however, lower than the lighting pressure); and the mechanism is not engaged when the light is extinguished.

No. 8 cam is similar to No. 7 cam, but without the two low peaks. The peaks on both of these cams are perpendicular on one side. No. 9 pin is always used with these cams. The operation of this cam is shown on Chart No. 11, and differs in its action to that of No. 7 cam in that, at the point of extinguishing, the mechanism is engaged.

In Chart No. 11 there is a higher pressure available in winter than in summer. The consumption is very considerable, and it is necessary sometimes to raise the pressure above the lighting point perhaps an hour before lighting time. The lamps are extinguished at 1 a.m. In this case, there is no increase of pressure for cooking at breakfast or luncheon time; otherwise No. 7 cam would be used. There is no purposed increase of pressure to operate the mechanism at lighting time; but at extinguishing time there is a drop, with a subsequent rise of $\frac{1}{2}$ inch to normal.

THE CHEMICAL CONTROL OF GAS-WORKS.

By JOHN T. SHEARD, of Sheffield.

[A Lecture delivered before the Manchester and District Junior Gas Association, at Manchester University, last Saturday.]

Gas manufacture, in its modern developments, offers numerous illustrations of chemistry, successfully applied, having done much to promote the prosperity of the industry. But it presents, yet, to the chemist many problems that are difficult of solution, and obscure chemical reactions that are hard to resolve or elucidate.

In undertaking to speak to you on the chemical control of gas-works, I cannot hope to bring before you anything very novel or original. The technical literature of our industry is now so adequate and extensive that much of what I shall say must appear as an oft-told tale, even if I am able to present it in a new light. All that I can venture to attempt is to review so much of the field of the application of chemical knowledge and skill to the furtherance of gas manufacture as has come within my own observation. In so doing, I shall endeavour to make my remarks of practical service, by showing how the various problems that have to be solved are actually dealt with in a modern gas-works, rather than by dwelling on the deeper questions of theory that are involved, and which require for their satisfactory interpretation a more varied experience, and a fuller scientific equipment, than mine. At the same time, I shall point out the direction in which technical progress seems to be tending, and where more scientific investigation is required to further it. For this, I take it, is the aim of your excellent scheme for bringing together the learning and resources of the University and the needs of the industry—namely, to promote technical progress, by imparting knowledge of what is done, and by stimulating research to enable further advances to be made.

The chemical control of gas-works embraces (1) the examination of materials of manufacture, to determine their relative value, or to test their fitness and suitability for the various purposes for which they are intended; (2) the imposition of tests to reveal and check the chemical changes taking place at different points in the cycle of manufacturing operations; and (3) testing the purity or excellence, according to fixed standards, of the products of manufacture. I shall deal in this lecture with the first two branches only; and I shall refer only to coal gas.

COAL.

To begin then with the principal raw material, coal. It is very remarkable that coal, which is the source of so many and varied chemical compounds, should itself be so unresponsive to chemical investigation. Its ultimate composition—that is, the particular chemical elements which enter into its structure—may be ascertained without much difficulty; but of the precise manner in which these elements are built up—whether the coal substance consists of a mixture of definite chemical compounds existing in varying proportions, or, on the other hand, is one complex, yet quite definite, hydrocarbon, with minor foreign ingredients in heterogeneous mixture—little seems to be known. For this reason, not much guidance in the selection of coal for gas-making purposes is obtainable from purely chemical tests. Chemical examination, for example, will reveal how much carbon, hydrogen, and oxygen a coal contains; but it cannot inform us as to the proportion and manner in which these elements will combine when the coal is submitted to destructive distillation at any specific temperature. Destructive distillation results in the formation of a great variety of products; but probably most are due to secondary reactions following close upon the primary breaking-down of the coal substance. In the cold, certain solvents—as strong sulphuric and nitric acids, magnesic chloride, and pyridine—have been found to remove small, but appreciable, amounts of some constituent of coal (of what nature or importance, however, we are not clearly informed); and further research in this direction seems to be called for.

The most noteworthy result from the application of solvents, so far recorded, is that the binding or caking property, which is distinctive of most bituminous coals employed in gas manufacture, is affected when such coals, in fine division, are so treated. In this connection, I may remind you that coal stored in the open for any considerable time, and so exposed to the natural solvents of the atmosphere, deteriorates greatly in its caking power. I have found that two years' exposure of some gas coals has been sufficient to alter altogether the character of the coke yielded when the coal was carbonized.

SULPHUR CONTENT.

Something more definite and valuable may be learnt by chemical examination as to the sulphur content of the coal, and the amount of this impurity which will require to be dealt with by the gas manufacturer. Eschka's method, or a modification of it, is usually adopted; the coal being gently heated with magnesia or lime and an alkaline carbonate, until the sulphur is transferred to the new bases, when, after cooling, it may be dissolved-out, and estimated in the usual way. If, then, we determine the percentage of sulphur contained in a coal, and likewise the amount remaining in the coke from the same coal, we have the data from which can be calculated the total sulphur that will be distributed among the volatile products when the coal is carbonized. An uncertain amount of sulphur, varying from 1 lb. to 2 lbs. per ton of coal, will be combined with the tar and ammoniacal liquor; and the remainder will require to be provided for in purification.

COAL-TESTING.

After all, the sulphur content of a gas coal is in most cases a minor consideration. The principal product for which a coal is of value to the gas maker is the gas, and as to this, in regard either to quantity or quality, guidance can only be obtained by carbonizing the coal in the same manner as is done on the works, though on a smaller scale. Thus we come to coal-testing as generally understood, and the question of the scale on which it should be carried out.

Reliable indications of the gas-producing value of coals may be obtained with apparatus in which a few pounds or a few hundredweights, as well as when many tons, are treated at a time. When tests of many varieties of coals are to be made in a short time, and little material is available, the laboratory plant, in which a charge of 2¼ lbs., or the one-thousandth of a ton can be carbonized, is obviously indicated. When operated with skill and judgment (always provided the sampling of the coal has been properly carried out), this apparatus is capable of ascertaining exactly how much and what quality of gas the coal will yield. Its reliability does not, however, extend much farther. With larger plant, in which the charge is reckoned in hundredweights instead of pounds, there is more gas available for experiments on the impurities contained, while very reliable indications are obtained of the coke, and, in lesser degree, of the liquid residuals. For ascertaining the exact working result of a gas coal, including its yield of residual products, thus arriving at its absolute value to the gas manufacturer, the test must be carried out on the working scale.

Taking into account facility of operation and fullest serviceability, the coal-testing plant most suitable for the average gas-works is one in which 2, 3, or 4 cwt. may be carbonized at one operation; having suitable provision for collecting the residuals and purifying the gas. Iron retorts rather than clay ones are indicated, as being more reliable in the matter of soundness under variations in heating. It may be urged that conditions different from those of ordinary working are thus introduced, seeing that iron is so much better a conductor of heat than clay. But I doubt if the objection is so weighty as at first sight it appears. A retort ready to be charged may, with its immediately adjacent brickwork, be looked upon as a reservoir of heat stored up for ready transference to the coal to be distilled, which is at once greatly depleted by the introduction and commencing decomposition of the cold charge. The ability of the retort to furnish sufficient heat for the continuance of the carbonization is a matter, not so much of better or worse conduction of heat, as of the amount of fuel consumed in the furnace in unit time, and the efficiency of the setting. And if we compare the relative thickness and weight of cast-iron and fire-clay retorts, with their respective specific heats, we shall find there is very little difference between the two as regards the amount of heat they contain at carbonizing temperatures.

A further objection may be made that the temperature of distillation with iron retorts is not the same as with clay ones, and therefore different conditions are imposed. But this also weakens in force on investigation. For reasons of economy, iron retorts are not raised to quite so high a temperature as clay ones. But if protected, as they should be, with an outer lining of brickwork, they may be safely employed at from 1700° to 1750° Fahr.; and this is well above the mean acting temperature of carbonization. For although the works' retort is raised 100° higher (or up to 1850° Fahr.), this is immediately reduced very considerably by the introduction of the cold charge. The higher temperature is required, as already explained, to provide a reservoir of heat to draw upon. Now the mass of retort material, in the case of the experimental retort, is necessarily greater, compared with the weight of the charge, than in the larger works' retort, so that there may well be an equal or even greater amount of heat in the former at the commencement. And although the exhausted coke is not raised to quite so high a temperature at the close, this is somewhat compensated by the longer period allowed for the charge to remain in the retort.

In operating a coal-testing plant, it is of primal importance to secure the proper sampling of the coal; and the smaller the charge employed, the greater precautions must be taken to see that a fair average is obtained. But as gas coal is not generally distinguished by great uniformity of composition, it is safer to take the average result obtained from several charges than to endeavour by excessive elaboration in sampling to secure a single representative charge. And it must be borne in mind that coal from the same seam and colliery may vary very considerably from time to time, although the results obtained from samples taken from the same delivery will not differ by more than 2 or 3 per cent. To ensure accuracy in testing, it is always advisable to check the carbonizing results by adding together the weight of the products of distillation. Coke, tar, virgin liquor, and gas ought, in general, to total up to 95 per cent. or more of the weight of coal taken; the balance being accounted for in impurities removed, condensation in mouthpiece and ascension pipe, and loss. A useful factor to remember, for ascertaining the weight of gas, is that 1000 cubic feet of air weigh exactly 75 lbs. Therefore, by multiplying this figure by the specific gravity of the gas, or, what is the same thing, by taking three-quarters of the specific gravity and moving the

decimal point two places to the right, we arrive at the weight in pounds of 1000 cubic feet of gas.

Examination of Purifying Materials.

When we come to the examination of purifying materials, the ordinary methods of chemical analysis are available; but a reservation must be made with regard to oxide of iron. Oxide purifying material is valued for its iron contents; but the percentage of ferric oxide (or its equivalent) that it contains is not necessarily the measure of its purifying value. Thus chemical analysis alone does not suffice to indicate the value of any oxide for gas purification. Unless something be known of the actual behaviour of the material in the purifiers, the analysis should be supplemented by a test for absorption of sulphuretted hydrogen. In this test, which should extend to three or four foulings, the chief precautions to observe are: First, that sulphuretted hydrogen be entirely expelled, and the material saturated with clean coal gas before each weighing; and, secondly, that thorough revivification takes place after each fouling, which can generally be promoted or expedited by warming.

If the general characteristics of the class of oxide to which the material belongs are known, a reasonable indication of its value will be given by chemical analysis, which will embrace the determination of moisture, organic matter with combined water, iron reckoned as its equivalent of ferric oxide, lime, and siliceous matter. The second item—organic matter, &c.—is a very important constituent, but will have a different value according as it represents fibrous, peaty matter in a natural bog ore, or added material in the form of sawdust or wood turnings. The value of item three—ferric oxide—depends upon what is the actual chemical compound present, and the physical condition in which it exists. As regards chemical constitution, it is a mistake to suppose that only hydrated peroxide of iron, or ferric hydroxide, is of value for gas purification. I have no doubt that the mono-hydrated oxide is, under favourable conditions, the most efficient form; but both anhydrous ferric oxide and the magnetic or ferroso-ferric oxide absorb sulphuretted hydrogen, and, suitably prepared, are available for gas purification.

To show the influence of physical condition as affecting the value of an oxide, I may adduce the following experiment. A quantity of burnt spent oxide was taken, and divided into three portions. One portion was ground in a mortar until it passed through a sieve of 30 meshes per lineal inch; the second portion was ground more finely, so as to pass through a 90-mesh sieve; the third portion was left unground. All three were then mixed with corresponding amounts of sawdust and lime, and treated with sulphuretted hydrogen in exactly similar manner, with these results:

Table I.—*Absorption of Sulphuretted Hydrogen by Burnt Spent Oxide.*

	Unpulverized.	Pulverized.	
		30 Mesh.	60 Mesh.
	Per Cent.	Per Cent.	Per Cent.
First absorption	19·0 ..	17·8 ..	21·8
Second ,, ...	8·4 ..	14·7 ..	19·1
Third ,, ...	7·3 ..	7·9 ..	3·8
Fourth ,, ...	2·6 ..	4·2 ..	2·4
	37·3 ..	44·6 ..	47·1

Whatever the form of oxide employed, the same reaction with sulphuretted hydrogen takes place during purification—ferrous and ferric sulphides being formed; and when these are decomposed, and the iron re-oxidized during revivification, the resulting oxide must be the same whether anhydrous or hydrated oxide were originally employed. I am not aware that it has ever been actually determined whether the oxide is revivified in hydrated or anhydrous form. Dr. Bunte assumes that it will be hydrated, if care be taken to have sufficient moisture present. But if this be so, it must equally apply if the oxide were hydrated or if it were anhydrous to start with.

Lime and Refractory Materials.

It is unnecessary to go through the long list of materials that require to be analyzed or chemically examined in a gas-works; but I may be allowed to refer very briefly to two important substances—namely, lime and refractory material. Where lime is employed in gas purification, it is valued for its causticity—that is, the calcium oxide it contains; and this ingredient is best estimated by the sucrose method, which is not so generally known as it deserves to be. A 10 per cent. solution of sugar in water is employed, in which the calcium oxide, but not the carbonate, dissolves on gently heating. The amount is then determined by titration with standard hydrochloric acid, using phenolphthalein as indicator.

With regard to fire-brick material, it should be noted that analysis alone does not suffice to indicate its refractoriness. Therefore, while the determination of silica, alumina, iron, lime, and magnesia enable a good idea to be formed as to the quality of the material, its suitability for furnace-work can only be ascertained by combining with the chemical examination practical observation of its behaviour when exposed to the temperature at which it is to be employed.

Checking Manufacturing Operations.

The second division of our subject has to do with the chemical tests that are employed in the gas-works to check the manufacturing operations and ascertain the efficiency of the apparatus and materials employed. In dealing with this branch, I shall not attempt to mention all or very many of the numerous tests that have been introduced or suggested from time to time, but shall content myself with referring to such as, by their simplicity, adaptability, and efficiency, have justified their adoption. And while it is impossible in the time at disposal to enter into details as to the form of apparatus and the methods of carrying out the different tests, it may be well to point out their bearing on manufacturing operations, and to indicate where necessary the precautions that should be observed in order to ensure success. This design will be best carried out in connection with a general survey of gas-making procedure.

In carbonizing coal, the evolution of gas is subject to control quantitatively but not qualitatively. That is to say, we can, from the same coal, obtain at will a greater or less quantity of gas, by varying the temperature of distillation; but we cannot in a similar way discriminate as to the composition of such gas. Practically, the same constituents are present when the coal is carbonized at the lowest temperature at which a gaseous distillate is obtained as at the highest temperature that is feasible in actual practice. Certainly these constituents occur in different amounts as the temperature of carbonization is raised; but the point I wish to make is that we are unable to vary, in an arbitrary manner, the relative proportion of the different gaseous elements and compounds which together constitute coal gas. This is partly due to the fact that the coal and its products necessarily pass through a varying range of temperatures within the retort. Because to whatever heat the retort may be raised before being charged, the introduction of the cold coal reduces it, more or less considerably, at first. But could this disturbing factor be avoided, we should still be confronted with a somewhat similar result.

In a research recently communicated to the Chemical Society,* Messrs. Burgess and Wheeler have shown that coal, when ground very finely, and mixed with silica so that the heat might better penetrate it, yielded the same series of gaseous constituents through a range of temperature from 850° to 2000° Fahr. Certain constituents increase while others decrease in quantity, more or less regularly, with increasing temperature of distillation; so that although qualitatively the composition of gas produced at high heat is very similar to that produced at a much lower temperature, quantitatively the difference is very great. Practically, it comes to this, that with every increase in the carbonizing temperature we get a greater yield of gas of a lower quality, judged by both illuminating and calorific standards.

As regards the act of carbonization, then, control is limited to maintaining the requisite temperature, and providing for the removal of the gaseous products as fast as they are evolved. Determination of the temperature is best made by a pyrometer; a suitable form being Féry's spiral, which is both simple and efficient. Estimation by the eye alone is not to be relied upon, and fusible indicators, such as Watkin's recorders and Seger cones, though good in their way, are troublesome and somewhat indeterminate.

The heat-conducting power of refractory material, and its specific heat or capacity for storing heat, are factors of great consequence in this matter of retort temperature. With regard to specific heat, it is not generally recognized how large a proportion of the heat that is required to carbonize a charge of coal is already existent in the retort at the moment of charging. To raise an ordinary clay retort, 21 in. by 15 in. by 19 ft. long and 3 in. thick, to the carbonizing temperature of 1800° Fahr., requires 990,000 B.Th.U. Such a retort will carbonize 5¾ cwt. of coal in from five to six hours; and in this time 533,000 heat units will have been transferred from the retort to the coal and its distillation products. Of this amount, 46 per cent., or 247,000 units, are given up by the retort in falling from its original temperature of 1800° to 1350°, which is the average temperature of distillation. These calculations are based on the figure ·22, usually given for the specific heat of fire-brick. But there is, I believe, some uncertainty about the specific heat of materials at these high temperatures.

With regard to conduction of heat, also, not much reliable information is available. For every pound of coal carbonized some 800 units of heat have to be transferred through the walls of the retort; and it is obvious that if we could facilitate the transference of such heat by improving the conductivity of the retort material, a corresponding saving in the time of carbonization would result. The most satisfactory data regarding heat conduction that I have met with, is the statement of Dr. George Beilby that, as the result of experiment, he found 1 square foot of fire-brick, 1 inch thick, would pass 6·6 heat units per hour for each degree of difference between the temperature on the two sides. Applying this rule to the case of the 21-inch by 15-inch retort, and assuming a mean temperature difference between inside and outside of 450° Fahr., we get 450,000 heat units transferred, where 533,000 are required. Considering the many assumptions made in the calculations, the result may be said to be a not-out-of-the-way approximation; and it gives a show of confirmation to the correctness of Dr. Beilby's formula.

The Heating of Retorts.

The successful heating of the retorts is dependent in a large degree upon the proper design and construction of the setting. For the furnace and flues must be rightly proportioned in accordance with the fuel to be employed and the available draught, in

* See "Journal" for Jan. 3 (p. 25).

order that the combustion of the properly gasified fuel may proceed as evenly and as gradually as possible to completion. It is only after these things have been seen to, and when the furnace is receiving proper attention in the matter of regular charging with fuel and periodical pricking and clinkering, that we may proceed to exercise effective control over the economy of combustion, by means of the analysis of producer and waste gases.

Analysis of Producer and Waste Gases.

For this purpose, we may use the Bunte burette or the Orsat apparatus. Personally, I incline to favour the burette—an instrument which I consider to be, on the whole, the most serviceable ever introduced to the gas-works laboratory. Whichever apparatus is employed, the same caution applies with regard to taking the sample of gas. An iron or copper tube must on no account be used for this purpose, as it is liable to act chemically on the gases passing through it—absorbing free oxygen, or reducing carbon dioxide to monoxide. The new silica-ware tubes are very suitable for taking samples of gas from the flues, if the precaution be taken to wrap them with asbestos cord, in order to minimize their fragility. Another precaution worth mentioning is to make sure that the sample of gas has been brought down to the requisite temperature for analysis before its volume is measured off.

The analysis of producer gas will not so often be required, as inspection of the furnace and combustion chamber will reveal whether the proper conversion of solid into gaseous fuel is going on. But mere observation of the waste gas in the flues will not show if wasteful combustion be taking place. Assuming, then, that the samples analyzed represent the products of combustion entering the regenerators, or, in the case of direct-fired retorts, leaving the setting during a period of normal working of the furnace, let us go on to the interpretation of the results. It is generally recognized that there should be no carbon monoxide existing at the outlet from the setting, because this would imply incomplete combustion of fuel. But complete combustion cannot be assured unless excess of air be admitted to the combustion chamber; and therefore a satisfactory analysis should show some oxygen. The question is, How much may reasonably be allowed? The objection to excess of air is that it robs the furnace of as much heat as is required to raise it to the temperature at which it leaves the setting. With ordinary furnaces, this may be taken as not less than 1800° Fahr.; and with regenerators, as 1200°. And at these temperatures 44 per cent. and 28 per cent. respectively of the total heat generated in the furnace must, even under ideal conditions, pass away up the chimney. This heat loss is increased by the excess of air which must be allowed in practice, in order to ensure complete combustion. Thus, with a non-regenerative furnace, an analysis of chimney gas showing 2 per cent. of oxygen implies that 11 per cent. of excess air has entered the furnace—carrying away to the chimney 4 per cent. of the total heat generated therein. Oxygen to the extent of 5 per cent. means 32½ per cent. of excess air and 12 per cent. additional heat loss; so that of the total heat generated by the fuel burnt, less than half is utilized in the setting. With regenerative combustion, the loss of heat is not quite so great, because the flue gases are made to do auxiliary work in the regenerators, and thus enter the main flue at a lower temperature. With 2 per cent. of oxygen in the chimney gas, the heat loss, over and above what is irremediable, is 2½ per cent.; with 5 per cent. of oxygen, the loss is 8 per cent.; and with 10 per cent. of oxygen, the loss is 22 per cent. These calculations are based upon the combustion of carbon and dry air, and do not take into account the effect of aqueous vapour necessarily accompanying the air, which, by its high specific heat, adds very materially to the heat losses. But, on the other hand, it renders local service by transferring heat from a lower zone in the furnace to a higher one.

Table II.—*Some Heat Losses in Chimney Gas.*

One pound of carbon develops 14,550 B.Th.U., and produces by its combustion—

		Heat Units in the Products of Combustion. At 1800° Fahr.		At 1200° Fahr.
3⅔ lbs.	CO_2	2112	..	1232
8·9 ,,	N_2	4325	..	2777
		6437 = 44 p. ct.	..	4009 = 28 p. ct.

Oxygen in Chimney Gas.	Excess Air.	Additional Heat Losses per Pound of Carbon. At 1800° Fahr.		At 1200° Fahr.	
Per Cent.	Per Cent.	B.Th.U.	Per Cent.	B.Th.U.	Per Cent.
2 ..	11 ..	585 ..	4 ..	375 ..	2½
5 ..	32½ ..	1755 ..	12 ..	1125 ..	8
10 ..	93 ..	5026 ..	34 ..	3222 ..	22

Condensation.

Condensation is occupied with physical rather than with chemical changes, and yet, as its carrying out affects for good or ill the chemical constitution of the finished gas, it may rightly be considered as coming within our subject. While the reduction of temperature and the alteration in physical condition of the distillation products constitute the chief purpose of the condensing plant, other and important changes are concerned therein. It was well said by Bowditch, forty years ago: "The proper object of condensation is the removal from gas of substances produced in the distillation, which, for some reason, are not useful for the purpose of illumination, and the retention in the gas of all the substances which are useful as illuminants and can be distributed with the gas." If mere cooling of the permanent gases and liquefying of vapours were needed, the object might be achieved in very summary fashion. But in the course of condensing the volatile products of carbonization, a selective action takes place (whether we will it or no) among those hydrocarbon vapours which normally assume the liquid form on cooling, but under favourable conditions may be carried forward with the gas. It is, therefore, advisable to do what may be done to ensure that as large a proportion as possible of the desirable constituents remains in the gaseous form, and that all the undesirable ones become liquid. The purified gas could, for example, carry all the benzene, toluene, xylenes, and cumenes that are produced, to its great advantage, both photometrically and calorifically, were the heavier tar prevented from absorbing these valuable hydrocarbons. An adequate control of the condensing process is, however, impossible while we are unable to effect the systematic separation of the numerous condensing substances. All that usually is done towards it is to cool the crude gas gradually, and remove the liquid products from the condensing mains as fast as they are produced. And it is generally acknowledged that this treatment favours the retention in the gas of the valuable hydrocarbons mentioned.

As to the temperature to which the gas should be cooled, too rigorous treatment is not desirable. Speaking generally, it may be said that not before the scrubbers are reached should the gas get down to about 60° Fahr. Experiment has shown that exposure of gas to tar below 80° Fahr. is detrimental to the illuminating power; and, therefore, it seems imperative that all tar-fog should have been extracted by the time the gas has been reduced to this temperature.

Naphthalene Treatment.

The same treatment is favourable to the avoidance of naphthalene troubles. Tar from the hydraulic main contains from 6 to 8 per cent. of naphthalene; while that from the cooling mains and condensers contains up to 18 or 19 per cent.—showing how much of this undesirable constituent condenses out of the cooling gas, and how advisable it is to remove the tar containing it from needless exposure to the gas. This is further illustrated by an experiment in which a Livesey washer was heated by steam. Gas entered the washer containing 8½ grains of naphthalene per 100 cubic feet, and left it with 11½ grains; the increase being due to liberation of naphthalene from tar in the washer. The benzene series of hydrocarbons, which it is desirable to retain in the gas for the benefit of its illuminating power, provide in themselves also the best natural solvents for naphthalene; and if they are present in the gas when conditions favour the deposition of naphthalene, the solvents likewise condense and (if in sufficient quantity) prevent the naphthalene assuming the solid form. The most successful remedies for naphthalene troubles, where these exist, are based upon increasing artificially the amount of these constituents in the gas. Benzene and toluene are themselves not so suitable for this purpose, because of their too great volatility, which is not favourable to their flowing away with the dissolved naphthalene to the syphons. But the xylenes and cumenes, or other solvent hydrocarbons of approximately similar boiling point—viz., from 130° to 170° C.—are employed.

The method of determining the amount of these solvent hydrocarbons in the gas depends upon the fact that they dissolve in, and are retained by, the heavy coal-tar oils. From 50 to 100 cubic feet of gas are caused to bubble, at the rate of about a foot an hour, through anthracene oil, cold, but which has been previously raised to the temperature of 270° C., so as to remove all volatile constituents. The oil is subsequently re-distilled; and the distillates which have been recovered from the gas are collected. The proportion of these hydrocarbons which the gas should contain will, of course, depend upon the quantity of naphthalene carried by the gas, and whether or not the enriched gas is required to free the mains from already existing deposits of naphthalene. Generally one would expect from 100 cubic feet of gas as it enters the distributing mains, in addition to hydrocarbons of lower boiling point, from 20 to 25 c.c. of liquid hydrocarbons coming over between 130° and 170° C., which amount is equivalent, as vapours, to not more than 0·2 per cent. by volume of the gas, but is twenty times as much as the naphthalene that is likely to be present.

The estimation of naphthalene itself is carried out by Colman and Smith's well-known picric acid method. In this connection, it is important to note that india-rubber tubing readily absorbs naphthalene, and must therefore be very sparingly employed in connecting-up the apparatus.

The Self-Purification of Gas.

When we arrive at the washers and scrubbers, we are confronted with chemical purification proper. The subject of complete self-purification of coal gas, by means of its own ammonia, has long had a strong fascination for inventors; and, judging by proposals that have recently been put forward, the attraction does not diminish. The problem is, however, being attacked in new ways, designed to meet the changed conditions of gas manufacture. Formerly, purification in closed vessels meant no more than the supplanting of lime and oxide by ammonia. Considered chemically, the change in procedure was but the substitution of a volatile base for a fixed one. With the altered conditions of modern gas supply—calorific value coming more to the front and illuminating value receding in importance—the old requirements have not now to be met. There is not the same necessity, for instance, to remove carbon dioxide from the gas, since the deteriorating effect it has on calorific power is only one-third of what

it exerts on illuminating power; and sulphur compounds are not the bugbear they once were. Then purification by oxide is so cheap that if the removal of sulphuretted hydrogen alone were to be considered, it is questionable if it were worth while seeking a substitute. The new proposals, with which the names of Feld and Burkheiser (to mention only two prominent workers) are identified, aim, however, at bringing about, along with the removal of ammonia and sulphuretted hydrogen from the gas, the oxidation of the sulphur and the subsequent combination of the two impurities to form sulphate of ammonia. The project is ambitious, though the object is laudable enough; and we may well hope that practical success will eventually be attained. As yet it is hardly in sight.

Something like half the total ammonia that is yielded by the coal condenses, along with the aqueous vapour, to form the so-called virgin liquor which deposits in the hydraulic and condensing mains. Owing to the fact of its removal from the gas at comparatively high temperatures, this liquor is not saturated to anything like the extent it is capable of with the acid gases carbon dioxide and sulphuretted hydrogen. It is, therefore, employed in the washers and scrubbers that it may take up more of these impurities, and also absorb some of the gaseous ammonia left in the gas. As it leaves the condensers, the gas will contain from 200 to 250 grains of ammonia per 100 cubic feet; and the proportion of this amount which may be absorbed in the scrubbers is dependent upon the ammonia-tension of the liquor employed and its temperature—the cooler it is, and the weaker it is, the more will it absorb. A liquor strong in ammonia, exposed to an atmosphere whose ammonia tension is lower than its own, gives up ammonia to the gas rather than absorbs it. Therefore, as the quantity of ammonia in the gas is reduced, the weaker must be the liquor used to wash or scrub it, until eventually the last traces are only removed by means of clean water.

While on the subject of the clean-water scrubber, it may be noted that the hydrocarbons, benzene and ethylene, to which the illuminating power of coal gas is chiefly due, are distinctly soluble in water; and the colder the water, the greater is the injurious effect. Although gas can be cooled far below the freezing point without its illuminating power suffering if no water be present, a drop of 20° below the normal of 60° Fahr., in the presence of water, is sufficient to reduce its illuminating power by 1 or 1½ candles.

The carbon dioxide in the gas produced from coals such as are chiefly used in this district will amount to some 2000 grains per 100 cubic feet, and the sulphuretted hydrogen to 800 or 1000 grains. Of these impurities, the ammonia is capable of extracting about one-sixth of the whole. As carbon dioxide is in preponderating amount in the gas, and has also more strongly acid properties, it will accumulate in the liquor to the exclusion of sulphuretted hydrogen, until the liquor, if sufficiently exposed in the washers and scrubbers, contains four or five equivalents of carbon dioxide to one of sulphuretted hydrogen. This is of advantage, as it is an easier matter to remove sulphuretted hydrogen in the subsequent purifiers than carbon dioxide. For this reason, it is better, where there are several washers and scrubbers, to work them in series than in parallel, when the conditions of pressure, &c., will allow of this being done. In practice, however, it is generally a matter of greater concern to promote the absorption of ammonia by the liquor, so as to increase its "strength," than to augment its contained impurities. Fortunately, the procedure that is favourable to the one object is not unfavourable to the other.

Ammoniacal Liquor a Complex Mixture.

Ammoniacal liquor, as produced in gas-works, is a very complex mixture of ammonia compounds. Although its valuable ingredient, ammonia, is itself readily determined, the methods available for a fuller analysis have hitherto been unsatisfactory. Of late years, however, the subject has claimed the attention of several eminent chemists; and in the laboratory of the Chief Inspector under the Alkali Acts the various analytical methods have been subjected to rigid investigation, with the result that a reliable scheme of analysis has been formulated, and is printed in the report for 1909.* The thanks of all interested in this subject are due to Mr. Linder, who undertook the work, for the painstaking labour he has devoted to the research and the thoroughness with which he has carried it out.

In the recovery of ammonia in gas-works, and its working up into sulphate by means of modern plant, quite remarkable efficiency may, with reasonable attention, be secured. At the outlet of the clean-water scrubber, there need not be more than one or two grains of ammonia per 100 cubic feet of gas; and even this amount, though lost to the liquor, is not altogether wasted, since it is of service in the subsequent purifiers. Ammonia to the extent of 2 grains is equivalent to 0·4 or 0·5 per cent. of the whole amount recoverable.

In sulphate manufacture, the working losses, when the plant is in proper condition, should not exceed about 0·06 per cent. of ammonia in the liquor dealt with, or from 2½ to 3 per cent. of the whole. This amount is made up as follows: The spent liquor from the ammonia stills may contain up to 0·02 per cent. of ammonia (free and combined), equal to less than 0·04 per cent. on the liquor distilled; the effluent from the devil's still (where one is employed) will not contain more than 0·04 per cent.—equal to (say) 0·02 per cent. of ammonia on the original liquor; while the saturator gases, amounting to 2 or 3 cubic feet per gallon of liquor distilled, should not carry away more than about 0·25 grain per cubic foot, which is a negligible quantity. But while these economies are obtainable by the exercise of needful care and attention in working, the possibilities of loss during the storage of liquor and its transit are very considerable. Wherever liquor is exposed to the air, ammonia evaporates therefrom; and so freely does this action take place that, even in a still atmosphere, as much as from 3 to 5 per cent. of the whole amount exposed may be lost in 24 hours. Because of this, a notable economy of ammonia is to be expected when a process has been perfected (and many inventors are at work on the problem) that will allow of the ammonia being fixed with acid as fast as it is produced—doing away with the necessity for storing any ammoniacal liquor.

Cyanogen Recovery.

Cyanogen, like ammonia, but in lesser degree, may be viewed either as an impurity to be removed or as a residual to be recovered. As an impurity, it is objectionable mainly because of its tendency to form ferrocyanide in the presence of iron salts; thus giving to ironwork a blue colour. The little that remains in purified gas, where no special means are taken for its recovery, is of no material consequence, as on its combustion with the gas it yields merely carbon dioxide and nitrogen. The proportion existing in crude gas varies unaccountably under apparently similar conditions of manufacture. Thus I have found at different times, at the inlet of the purifiers, hydrocyanic acid equivalent to from 2 to 5 lbs. of yellow prussiate of potash per ton of coal carbonized. The question whether the recovery of cyanogen as a residual product should be undertaken or not has to be decided by local economic considerations alone. Until a vastly increased demand for cyanide arises, its recovery cannot become at all general. When (if ever) it does, there are several suitable processes available. But in view of the limited interest of the subject, it is unnecessary now to say more. Spent oxide, which absorbs more or less of the impurity, is occasionally valued for its cyanide contents; but the conditions most favourable for the use of oxide for its principal purpose—that of absorbing sulphuretted hydrogen—are not the most conducive to the recovery of ferrocyanide; and therefore a high value for this constituent is not to be expected. The most I have found has been equal to 7½ per cent. of prussian blue; the amount is usually much lower.

Modern Purification Requirements.

The problem of gas purification has been much simplified in recent years by the removal of the obligation to take out bisulphide of carbon—in other words, by doing away with the limit for sulphur compounds other than sulphuretted hydrogen. It is worthy of remark that the change in procedure thus brought about has been quite unnoticed by the general public—showing that the alteration was not one to the prejudice of the gas consumer. One now hears fewer complaints regarding sulphur in the gas than ever before. This is probably due to two causes—first, the outcry was largely a factitious one, and the nuisance complained of more fanciful than real (which has indeed been proved by the investigation of Messrs. Hehner and Rideal in London, and Bedson in Newcastle); and, secondly, natural ventilation is not objected to so much as formerly—fresh air being more tolerated both in dwelling houses and public rooms. That sulphur purification under the old conditions was not worth the expense and nuisance it entailed, all are agreed. At the same time, it may be admitted that could a reasonably cheap, simple, and unobjectionable method of eliminating bisulphide be established, it would be both the interest and duty of suppliers of gas to reconsider the matter. So far, the only practical alternative to the discarded sulphide of lime method that has appeared is Mr. Harcourt's hot metals treatment, which has been revived in America, where it is said to be a success. An investigation of the possibilities of the process, in the light of modern conditions, seems to be worth undertaking.

A little bisulphide is removed from the gas in oxide purifiers, through a simple solvent action on the free sulphur existing in the material. But it cannot amount to much. The most favourable result I have found has been a reduction from 39 to 33½ grains of sulphur as bisulphide after passing through oxide containing 60 per cent. of sulphur. Unfortunately, bisulphide thus absorbed is liable to be given up again to the gas if the oxide becomes active and its temperature rises. This may perhaps account for the sudden increase of sulphur compounds in the gas, which sometimes occurs without apparent cause.

Sulphuretted Hydrogen and Carbon Dioxide.

The impurities remaining for consideration are sulphuretted hydrogen and carbon dioxide. A general reduction in illuminating power standards has been taking place during the last few years, which has reduced the necessity for eliminating carbon dioxide; and in consequence thereof many gas-works have been enabled to do away with lime purification altogether. This movement will continue to spread; and as illuminating power ceases to be the dominating consideration, carbon dioxide will be seen in its true light as an impurity only in the sense that it is an innocuous diluent of the gas. Thus dry purification will come before long to refer solely, as now it does chiefly, to the use of oxide. On this account, and because the removal of carbon dioxide by lime presents no technical difficulties, I will pass on to consider oxide purification. But first a word as to

Determining the Impurities in the Gas.

For rigid accuracy, Mr. Lewis Wright's plan of absorbing them in weighed U-tubes is undoubtedly the best; the gas being

* See "Journal," Vol. CXI., p. 21.

measured by a meter after the absorption, and from ½ cubic foot to 2 cubic feet passed, at the rate of ½ cubic foot per hour. Carbon dioxide alone can be determined with sufficient accuracy for many purposes by the Bunte burette. For checking the working of the purifiers, and revealing the course of purification, a quick and handy method of determining sulphuretted hydrogen is required; and there are several such to choose from. These are confessedly not strictly accurate, but give results approximating sufficiently near the truth to serve the purpose for which they are intended. It is perhaps not out of place to remind you of the valuable service which simple test papers, lead and litmus, are able to render. An acetate of lead paper will in a second or two reveal the presence of less than a grain of sulphuretted hydrogen per 100 cubic feet of gas, while a red litmus paper will show a grain or more of ammonia per 100 cubic feet, even when the reaction is interfered with by excess of carbonic acid, and a much smaller quantity in the absence of the latter.

The first requisite for successful purification by oxide is an active material. As I have already pointed out, this is not altogether a question of the chemical composition of the material. Some examples may make this clear. In the laboratory, oxides are compared by observing the amount of sulphuretted hydrogen they will absorb. This does not exactly represent their behaviour in the purifiers, but is an approximation thereto; and it may, for our purpose, be termed the potential efficiency of the oxide. Knowing the percentage of ferric oxide equivalent in the material, it is possible to calculate the sulphuretted hydrogen which should be absorbed by it, on the basis of three equivalents of the impurity to one of ferric oxide. If now we take this theoretical amount, and ascertain the percentage thereof actually absorbed, we arrive at what may be termed the iron efficiency of the oxide. On these lines, four oxides were examined, with the following results:—

TABLE III.—*Absorption of Sulphuretted Hydrogen by Oxides.*

Oxide.	Potential Efficiency. Per Cent.	Iron Efficiency. Per Cent.
No. 1	24·5	86
,, 2	23·5	65
,, 3	19·0	71
,, 4	16·7	55

No. 1 was an artificial, precipitated (and therefore hydrated) oxide. (2) Another artificial oxide. (3) Burnt oxide with sawdust. (4) A bog ore. These results embraced one absorption only, and show that though the sulphuretted hydrogen absorbed bears some relation to the ferric oxide contained in the material, the parallel is not a close one. But it is unwise to limit the test to one absorption, as the following comparison will show. Two natural oxides absorbed as follows:—

TABLE IV.—*Comparative Absorption of Sulphuretted Hydrogen by Two Oxides.*

	No. 1. Per Cent.	No. 2. Per Cent.
First absorption	16·7	12·7
Second ,,	11·2	12·7
Third ,,	7·2	12·7
Fourth ,,	6·5	6·4
	41·6	44·5

The second example proved to be an efficient material, accumulating 56 per cent. of sulphur after nine times in the purifiers, whereas a test limited to one absorption might have condemned the oxide.

The measure of the efficiency of an oxide in practice is inversely as the amount of labour that has to be expended upon it, or the number of times it must be charged into, and emptied out of, the purifiers before it has accumulated a sufficiency of sulphur for its disposal to the chemical manufacturer—say, 55 per cent. calculated on dry material. Obviously, this will be influenced by two factors—the extent and efficiency of the purifying plant available, and the skill that is exercised in preparing and revivifying the material. Ordinarily, and with good oxide, from eight to twelve times will suffice.

PREPARING OXIDE FOR THE PURIFIERS.

In preparing oxide for the purifiers, it is a not uncommon mistake to make the material too moist. Water is not required to facilitate the chemical reaction, but only to agglomerate the dusty particles, so that the material shall be open and easily permeable by the gas. Speaking generally, the drier the oxide (other things being equal), the more effective it is. In most cases a suitable amount of moisture will be nearer 5 per cent. than 10 per cent.

The efficiency of oxide is increased by the presence of oxygen in the gas, and it is usual to introduce a percentage of air for this purpose. In deciding how much is to be admitted, regard should be had to the amount of oxygen already existent in the gas; for it is not uncommon to find that air is being unwittingly drawn into the gas-mains through defects on the exhaust side of the exhauster. Theoretically, from 0·5 to 0·7 per cent. of oxygen is needed for continuous revivification; so that up to 2 or 2½ per cent. of air may be introduced. This amount may be employed with but little detriment to the quality of the gas. It is a moot point at what part of the plant the air should be admitted. If introduced at the condensers, there is a possibility of its picking-up and carrying forward some hydrocarbon vapours. On the other hand, the oxygen exerts a rusting action on the iron apparatus, and causes increased fixation of ammonia compounds in the liquor. For this reason, the air is best admitted at the outlet of the scrubbers or the inlet of the purifiers.

ROTATION OF PURIFIERS.

Several methods of operating oxide purifiers are in use. Under the older system, the newly-charged box came on last in the series—only getting into active operation as the boxes in front of it were spent, and it was deemed necessary to have the first one emptied and refilled. By the newer method, the clean box is made the first in the series, and absorbs the bulk of the sulphuretted hydrogen and a portion of the oxygen, while the greater part of the oxygen goes forward to promote revivification of the oxide in the already fouled boxes. Thus the efficiency of these latter is renewed, and they may again take their place in the working rotation. When the efficiency of the first box falls off considerably, a change is made—the series being operated in the order 1, 2, 3, 4; 4, 1, 2, 3; 3, 4, 1, 2; 2, 3, 4, 1. In deciding when to make a change in the rotation and when to renew the oxide, regard will, of course, be had to the condition of the material and the number of succeeding purifiers. With a full set of four boxes in use, there should be sufficient catch-box area available for emergencies.

By another method, a change is made once in every 24 hours; the object in view being the same—namely, to abstract the bulk of the impurity in the first box, and allow the oxygen to prosecute its mission of revivification in the succeeding boxes. The sulphiding of the oxide proceeds much more readily than does reconversion to oxide by absorption of oxygen. With this system, the changes may take the following order: 1, 2, 3, 4; 2, 3, 4, 1; 3, 4, 1, 2; 4, 1, 2, 3 (that is, changing forward); or the reverse, 1, 2, 3, 4; 4, 1, 2, 3; 3, 4, 1, 2; 2, 3, 4, 1 (that is, changing backward). On the Continent, where this so-called "switching" system is largely used, the former sequence is said to be preferred; but it appears to me that the latter should be more efficient, and for this reason: The reaction between sulphuretted hydrogen and oxide produces three equivalents of water which, being carried forward with the gas, is more or less deposited in the second box. Thus it would appear that an excessive amount of moisture must accumulate in the oxide of the second box, making it less efficient for the removal of the impurity. It is a caustic commentary on the insufficiency and inexactness of our knowledge of what actually takes place in the purifiers, that there should be room for two opinions on such a subject.

THE ECONOMICS OF PURIFIER INSTALLATIONS.

By R. J. MILBOURNE, Assoc.M.Inst.C.E.

WHEN called upon to take into consideration the question of the installation of a set of new purifiers, the gas engineer will find, in the majority of cases, that, at the very outset, and before approaching the matter in any detail, one all-important problem stands out prominently and demands definite decision. This is the question as to whether it is advisable, or best, to place the new purifiers on the ground level, or to erect them "overhead" on a superstructure of columns and girders. It will sometimes happen that there is little choice open to the engineer in the matter, or, to put it into the words of a familiar proverb, that the only choice is the variety commonly known as "Hobson's."

Unfortunately or otherwise, as may appear, the question is often settled by force of local circumstances or conditions over which the engineer has no control. For instance, where the gas-works premises, and the plant generally thereupon, are to any serious extent congested, and the ground space available for extensions is limited, it will often happen that the only possible means of providing the required space for the new purifiers, and the necessary adjacent floor area for the revivification of the oxide, is to place the purifiers on an overhead framework of columns and girders; thus leaving the ground space underneath the purifiers available for the manipulation of the purifying material. In other cases, no such consideration or limitation will exist; and here the gas engineer will be free to exercise his professional judgment and discretion, and adopt either system as may appear best or most advisable. The object of this article, therefore, is to offer a few suggestions and raise a few points, more or less practical, as affecting the £ *s. d.* and the "economics" of the matter, which appear to the writer to be important and quite necessary to take into consideration.

On the face of it, there must be a saving in the annual wages bill, due to the lower cost of working a properly-equipped set of purifiers fixed overhead, as compared with a similar set fixed on the ground-floor level. This saving will vary, however, on different gas-works according to the total number of times in the course of a year that it is found necessary to change a purifier. This is influenced to a very considerable extent by the proportion which the area and capacity of the purifier boxes bear to the volume of gas that has to be passed through them within twenty-four hours at the busiest season, as well as being affected by the design and construction of the purifiers, their sufficiency in number, and by the question as to whether atmospheric air is passed into them for the purpose of partially revivifying the oxide *in situ*.

The writer has one instance in mind where a set of overhead purifiers is worked with such skill, and under such close and constant supervision, that each purifier runs for about fifteen months after being put into action. The oxide, when received at the gas-

works, is suitably prepared and placed in the purifiers, and then worked continuously. On analyzing the oxide as it comes from the purifier for the last time, it is found to contain about 61 per cent. of sulphur and some 7 per cent. of moisture, and is therefore ready for sale to the chemical manufacturers. There are now several gas-works where a small profit on purification is regularly shown; but it is hardly necessary to say that such a satisfactory result can only be obtained where the purifiers are ample, both in size and in number, to deal with the maximum daily make of gas, and where, further, before reaching the purifiers, the gas passes through properly-designed and effective condensing, washing, and scrubbing plant—ensuring that the gas shall be entirely free from tarry matter and ammonia—and enters the purifiers at a temperature most suitable for efficient and economical purification.

Taking, now, the case of overhead purifiers as compared with similar boxes erected on the ground level, the chief advantages of this system may be stated to be:

(*a*) They are easy to empty and refill.
(*b*) They save time and labour.
(*c*) They save ground space by providing a covered floor area underneath the purifiers for revivification of the oxide.
(*d*) They (the purifiers and plant generally) are more easily maintained and kept in good order and condition, and therefore have a longer life.

On the other hand, the disadvantages that may be urged against the system, and in favour of purifiers on the ground level are:

(*a*) They increase capital outlay, by the cost of the superstructure, the elevator and conveyor, engine power, &c.
(*b*) The cost of maintenance, in wear and tear of elevator and conveyor plant, in painting, &c., is increased.

Coming now, in detail, to the various points enumerated above, we will take first

The Filling of Overhead Purifiers.

In dealing with the first advantage named (*a*), we will consider the time and labour expended in filling a purifier, and will take an actual example for one of the boxes of a set of four purifiers 20 feet square by 5 feet deep, with a total depth of 4 feet of purifying material—thus containing 20 ft. by 20 ft. by 4 ft., or 1600 cubic feet of oxide; and we will detail the results of an actual trial. After the sieves were placed ready to receive the first portion of the oxide, two men were told off to convey and shovel the oxide into the boot of the elevator. Two other men were stationed in the purifier, ready to receive and evenly spread the oxide as it was delivered to them from the overhead conveyor down the swivel steel shoot. The conveyor in this example runs directly down the centre of the purifier-house, and is supported by the tie bars of the roof principals. The purifiers being arranged "in square," this swivel steel shoot has to deliver the oxide into the boxes on either side of the centre line of the house. The oxide in contact with the side and end plates, and at other places where necessary, was carefully and sufficiently rammed, so that no "short-circuiting" in the passage of the gas through the material should be possible. The total time the four men were actually engaged in the operation of filling the box amounted to 16 hours—four men four hours each.

Looking closely into these figures, they show that the filling of the purifier referred to with purifying material by means of elevator and conveyor absorbed

$$\frac{16}{1600} = 0{\cdot}01 \text{ hour of manual labour per cubic foot of oxide.}$$

This gives us a factor which can now be compared with the results obtained in the case of a set of purifiers similar in every respect to those already mentioned, but erected on the ground level, and filled also with a total depth of 4 feet of oxide by manual labour exclusively—using hand barrows for the conveyance of the material from the revivifying shed to the purifier-box.

The Filling of Purifiers on the Ground Level.

After the lower tier of sieves had been placed in position ready to receive oxide, seven men were deputed to load up and wheel the oxide from the shed to the purifier into which it had to be tipped, and one man was stationed in the purifier to receive the material and properly spread it over the area of the purifier—carefully ramming the oxide where necessary, as previously described. Filling the purifier in this way, took these eight men a total of 56 hours (eight men seven hours each) to complete the task; and on reducing this again to the time required per cubic foot of oxide dealt with, we see that it took

$$\frac{56}{1600} = 0{\cdot}035 \text{ hour of manual labour per cubic foot of oxide dealt with.}$$

Deducting one result from the other, we find that the overhead system effected a saving of

$$0{\cdot}035 - 0{\cdot}01 = 0{\cdot}025 \text{ hour}$$

per cubic foot of oxide dealt with, which represents a saving in the wages bill. If we assume the rate of wages paid for this class of labour as 6d. per hour, the net saving would be represented by

$$\frac{1600 \times 0{\cdot}025 \times 6}{12} = 20\text{s.}$$

This would be the amount saved each time a box 20 feet square had to be filled.

Before passing on to consider the emptying of the purifiers under the two systems we are dealing with, it may be advisable to mention, at the outset, that the state in which the oxide is found in the purifier should be considered. Its condition prior to removal from the purifier varies very considerably in different gas-works. In many cases it is found possible to remove the whole of the spent oxide by using ordinary shovels. At other gas-works, shovels and three-pronged forks are required; and in some instances it is necessary to use a pick for breaking up and dislodging the oxide before it can be thrown out by means of the shovel. These facts tend to make the attempt at comparison between the two systems of purifiers somewhat difficult; but the writer has chosen examples in each case where the conditions may be considered as practically equal.

The Emptying of Overhead Purifiers.

We will now consider the labour that is required to empty one of the overhead purifiers. After the air-plugs on the cover had been opened, the cover fasteners released, and the cover lifted, travelled, and lowered on to the timber bearers placed ready on top of the adjoining purifier cover to receive it, four men were instructed to open the discharge shoots and empty the purifier. This work occupied the men a total of 28 hours in all (four men seven hours each) to accomplish. The amount of oxide in the purifier, as previously stated, was 1600 cubic feet; and by dividing this into the total time required, we find that each cubic foot of material removed from the purifier to the revivifying floor below absorbed

$$\frac{28}{1600} = 0{\cdot}0175 \text{ hour of labour.}$$

It should be noted that this purifier was fitted with discharge doors and perforated trays of an ordinary type; and the opportunity here presents itself to draw attention to an important point in designing new installations of overhead purifiers, as concerning the proper and requisite number of discharge shoots and doors to be fitted to a purifier-box. Owing to the unsatisfactory design or form of most discharge shoots, the time and trouble expended in rigging up lifting tackle for the removal of trays or hoods, or of sections of the discharge pipes, and the consideration that these fittings reduced the effective area of the purifiers to some appreciable extent, gas engineers have no doubt been disposed to put in the very least number of shoots to each box that could be reasonably considered as sufficient. At the same time, they may have been quite conscious of the fact that with only one such discharge shoot in (say) a 25 feet or 30 feet square purifier, there must necessarily be an undue amount of second handling and shovelling of the purifying material, involving waste of time in emptying a purifier. In certain conditions of the oxide, when a purifier is open for emptying (as gas engineers and managers well know) expeditious discharging and spreading of the oxide on the revivifying floor is of great importance. These difficulties and troubles have recently been successfully overcome by the safety automatic discharge shoot invented by the writer, which was fully described in the "Journal" for Oct. 18, 1908.

The Emptying of Purifiers on the Ground Level.

We will now inquire into the time occupied in emptying purifiers when erected on the ground level. For this purpose, the writer has taken an example of a set of four purifiers of the same dimensions as those already referred to—namely, 20 feet square by 5 feet deep, with 4 feet total depth of purifying material; the purifiers being arranged in line, with oxide revivifying shed running parallel along one side of the line of purifiers. It will readily be seen that, as a practical example of such a set of purifiers, the distance over which the oxide has to be carried to or from the purifier is reduced to a minimum.

After the purifier cover was lifted and moved out of the way, eight men were occupied for a total time of 67 hours (8·375 hours per man) in emptying the box; each cubic foot of oxide removed thus consuming

$$\frac{67}{1600} = 0{\cdot}0418 \text{ hour of labour.}$$

Comparing this result with that obtained in emptying the overhead purifier, we find that there is a gain of $0{\cdot}0418 - 0{\cdot}0175 = 0{\cdot}0243$ hour of labour for each cubic foot of oxide removed from the box in favour of the overhead system. Assuming again, as before, the rate of wages for this labour to be 6d. per hour, the net saving amounts to

$$\frac{1600 \times 0{\cdot}0243 \times 6}{12} = 19{\cdot}44\text{s.}$$

on the emptying of a single box. By adding together the time required to empty and to refill such boxes, we obtain totals, in each case, as follows:

Overhead Purifiers.

To empty 1 cubic foot of oxide	= 0·0175	hour of labour per cubic foot of oxide.
To fill 1 " "	= 0·0100	
Total	0·0275	

Ground-Level Purifiers.

To empty 1 cubic foot of oxide	= 0·0418	hour of labour per cubic foot of oxide.
To fill 1 " "	= 0·0350	
Total	0·0768	

and from these figures

$$0{\cdot}0768 - 0{\cdot}0275, \text{ or } 0{\cdot}0493 \text{ hour}$$

represents the labour saved per cubic foot of oxide by the overhead system, amounting to

$$\frac{1600 \times 0{\cdot}0493 \times 6}{12} = 39{\cdot}44\text{s.}$$

each time a purifier has to be emptied and refilled.

These results, then, present the following question for consideration: Is it true and fair, or otherwise, to say that the gain in time and economy in working that accompanies the overhead system is nullified by the increased cost, which would consist of the maintenance of the elevator and conveyor, engine, cost of driving, and the interest on increased capital on this additional plant, and in the structure of girders and columns required in order to effectively support the purifiers? This question can only be answered by comparing the cost of a set of purifiers on each of the two systems. It might be urged, in the case of purifiers erected on the ground level, that a roof over the purifiers and one to cover in the oxide revivifying floor are not absolutely necessary. But to make the conditions analogous and the comparison fair, these items should undoubtedly be taken into account, in order that the two systems may possess equivalent advantages and conveniences, such as may be reasonably expected to be included in the case of a new installation on either system. Undoubtedly, many sets of purifiers are erected on the ground level without any covering or protection from the weather, and with the revivifying floor area similarly exposed. But the practice is not to be recommended for many very obvious reasons. In some cases, roofs on columns and girders are added at a later time, when experience has proved to the manager that neither purifiers nor oxide will give the best results in working when they are exposed to the inclemency and the changes of the weather. This course, of "making two bites at a cherry," has often been adopted in order to spread the capital expenditure over as great a period of time as possible.

The total cost at the present time of a set of four purifiers, 20 feet square by 5 feet deep, fitted with sieves, valves and connections, covers and lifting apparatus, erected on a system of cast-iron columns supporting girders to carry the purifiers, and provided with a slate roof, including the necessary foundations for columns, and brick walls to form one side and two ends of the building, also including elevator and conveyor and engine for driving same, would be about £2760. In order to obtain corresponding advantages with a set of similar 20 feet square purifiers erected on the ground level, this installation must include, as just pointed out, a roof over the purifiers, and have a suitable shed to cover the revivifying floor alongside the purifier-boxes. Such a set of purifiers, together with foundations and brick walls, would cost somewhere about £1870.

With regard to these figures, it might be well to point out that while the initial cost of each system is given, it may vary to some extent according to prices of materials, cost of labour, &c.; also whether the engineer is instructed to produce a "good substantial job," or to "make the cost as little as possible." Yet the relative or proportionate cost of the two systems, based on similar lines as described, will approximate to the figures given. These figures show the increased capital outlay, on the overhead system, to amount to: £2760 − £1870 = £890; and the question now to be decided may be stated thus: Does the saving effected in the emptying and refilling of the purifiers by the overhead system justify this increased capital expenditure? In answering this, much will depend upon the rate of interest it is desired that the capital shall return; and this will vary considerably in different gas undertakings. But for the sake of argument, it might be reckoned at (say) 4 per cent. per annum—a rate which would no doubt be satisfactory in the majority of cases. Taking, then, the extra capital expenditure (£890), 4 per cent. on this will amount to £35 12s.

Items for repairs and maintenance upon the overhead purifiers will also involve an extra charge under this heading being debited against the system; and there will also be a charge for depreciation, so far as the capital expenditure is concerned, to be allowed for. In considering repairs and maintenance, it is reasonable to assume that the only portions of the apparatus that need be taken into account in this connection will be the elevator and conveyor and engine; and if we take the original cost of these at £550, and allow 1¼ per cent. on this, we get an annual charge of £6 17s. 6d. under this heading. Other items under maintenance—such as painting—are so closely balanced in the two cases that they may be ignored in their bearing upon the matter under consideration. The amount to be written off yearly on account of depreciation—say, 2 per cent. on the amount of the extra capital expenditure (£890)—would be £17 16s.

The question of placing the value of the ground area saved under the overhead system to help to counterbalance the cost of the superstructure, elevator and conveyor, engine, &c., would, in some cases, require to be taken into consideration in assessing the relative value of the two systems. It is quite conceivable that this item would be of serious importance indeed if additional land as a site for the erection of the new purifiers had to be specially purchased. But such cases would no doubt be exceptional; and nothing more need be said under this heading, except, perhaps, to note the point in passing, so that, when necessary, it might have full weight given to its due consideration.

It might be noticed, too, that oxide of iron has alone been considered as the purifying material, for the simple reason that this substance is now almost universally used, on account of its great powers and capacity as a medium of purification, the freedom that its use secures from serious nuisance when purifiers are being changed, and its favourable comparative cost. Lime is now seldom used, except in the case of small gas-works. Even in the moderate-sized works now so rapidly being installed in the country towns of new lands like Australia, New Zealand, and other Colonies, the writer is informed that oxide, not lime, is almost invariably used for the purification of the gas. Even if lime were substituted for oxide, however, the comparative cost of the two systems of purifiers under consideration would not be affected to any appreciable extent.

We can now proceed to summarize the results arrived at:—

Purifiers on Ground Level.

Cost of emptying and refilling (say) four purifiers per twelve months, each purifier holding 1600 cubic feet of oxide.

$$= \frac{0{\cdot}0768 \times 1600 \times 16 \times 6}{12} = 245{\cdot}76\text{s.} = \ldots\ldots \quad £49\ 3\ 0$$

Overhead Purifiers.

Cost of emptying and refilling as above

$$= \frac{0{\cdot}275 \times 1600 \times 16 \times 6}{12} = 88\text{s.} = \ldots\ldots \quad 17\ 12\ 0$$

Difference = ... £31 11 0

Deducting the one amount from the other, the saving in labour from the use of the overhead system is shown to be £31 11s. annually; this being the saving, as the figures show, upon four changes of each purifier only in the course of the year. Where the changes necessary are more frequent, the saving must be multiplied or added to accordingly.

The remaining items which have to be taken into account and placed against the saving in labour due to the use of the overhead system of purifiers, are as follows:—

Interest on increased capital expenditure	£35 12 0
Allowance for repairs, maintenance, &c., on elevator and conveyor and engine	6 17 6
Depreciation on ditto.	17 16 0
Annual total	£60 5 6

It is thus seen at once that the actual advantage in the comparison is largely with the system of purifiers erected on the ground level so far as financial considerations alone are concerned. In many cases, however, the question of mere cheapness is not, and should not be, allowed to obscure and banish from view the great facility and expedition with which the changing of purifiers can be accomplished where they are upon the overhead system. The very great advantage of being able to empty and re-charge a purifier within a few hours will serve to prevent a lot of complaints as to bad or impure gas reaching the ears of the gas manager, and save him an immense amount of trouble and worry, to say nothing about the chances of his company being mulcted in "penalties." These considerations—all serious and important in their degree—can hardly be represented by a total in pounds, shillings, and pence. Furthermore, such facilities as accrue to the use of the overhead system of purifiers, and the power to bring them into use rapidly, help to preserve the kindly feeling of the consumer towards coal gas, not only as an illuminant, but as a really useful servant in the home, and to prevent his thoughts and affections turning towards a light produced by a medium that needs no purification.

Coronation Exhibition at Shepherd's Bush.

At a meeting of Gas Companies' representatives held at the offices of the Gaslight and Coke Company on Tuesday last, it was decided to organize a "Gas Companies' Joint Exhibit" at the forthcoming Coronation Exhibition at Shepherd's Bush—the building erected for the exhibit at the Japan-British Exhibition of last year being available. The appropriation of this building for the purpose was rendered a simple matter by the fact that the meeting elected as the Committee to deal with the exhibit at the Coronation Exhibition the same gentlemen who constituted the Committee for the Japan-British exhibit. The Committee will, therefore, consist of Messrs. A. E. Broadberry, James W. Helps, A. A. Johnston, Stanley H. Jones, F. M'Leod, S. Y. Shoubridge, and D. Milne Watson, with Mr. F. W. Goodenough as Honorary Secretary and Treasurer. The Committee will doubtless at an early date be issuing an appeal for contributions to the required fund for the effective carrying on of the exhibit; and it is hoped a ready and liberal response will be made to the appeal by a large number of gas undertakings. Experience at both the Franco-British and the Japan-British Exhibitions clearly proves that a joint exhibit such as that contemplated is of very widespread value to the gas industry as a whole.

Separating Ammonia from Gases.—Herr Henss has taken out a patent for Germany for a process for separating ammonia from distillation gases by means of sulphuric acid. According to an abstract of the specification in the "Journal of the Society of Chemical Industry," the hot gases, after passing the tar-extractor, are forced into a bath of sulphuric acid by means of an acid jet injector. The greater portion of the ammonia is absorbed by the acid in the injector, so that the pipe leading the gases into the sulphuric acid bath needs to dip only a short distance below the surface; and hence the gases rising from the acid are still under such pressure that they pass onwards to the gasholder without the use of special appliances.

TESTING INCANDESCENT GAS-MANTLES.

In the "JOURNAL" for the 10th ult. (p. 97), we gave a full abstract of a paper on the above subject presented by Messrs. J. H. COSTE and W. E. F. POWNEY at the first meeting of the London Section of the Society of Chemical Industry in the present year. The text of the communication, with the tabulated experimental figures which the authors threw upon the screen, is given in the current number of the Society's "Journal;" and in view of the interest attaching to the subject, we reproduce it in its entirety.

Very little information as to the comparative testing of incandescent mantles appears to be available. The Photometry Committee of the German Association of Gas and Water Engineers recommended a consumption of gas varying between 4 and 4·6 cubic feet per hour at a pressure of 1·4 to 1·6 inches of water. From this it appears probable that the ordinary "C" pattern burners were referred to, especially as chimneys 25 cm. long were to be used. The air supply seems to have been fixed, and the amount of gas adjusted until the highest illumination of the mantles was obtained. The durability of the mantles was to be judged by the alteration in illuminating power after 24, 100, and 300 hours' burning; and at least four were to be tested. This method would necessitate the expenditure of 13 days over a single test, and, if many mantles were to be tested, would involve the use of a very large installation of burners placed in a large special room, as an unpleasant amount of heat is radiated.

After trying various methods, the following have been adopted as requiring only a reasonable time, and giving a fair idea of the way in which mantles may be expected to behave in use.

DURABILITY TESTS.

Various appliances have been devised for subjecting mantles to a series of regular mechanical shocks. The authors were considering the question of designing one, when they found that the Metropolitan Gas Companies were using one which appeared to be of a suitable kind for their purposes. In the Woodall-Moon machine, a mantle, fixed on its proper burner, which is screwed on an upright stem, is, after having been "hardened" by "burning off" for about five minutes, subjected to a series of shocks administered by a miniature stamp-mill driven by a water-motor. The impacts occur on the lower part of the machine, and impart to the upright and the mantle on it vibrations which are probably not dissimilar to those occurring as the result of the passage of heavy traffic or of persons moving in rooms overhead. Varying weights can be used to load the rising and falling rods which give the shock. A counting apparatus for registering the number of shocks is provided; also an automatic extinguishing and relighting device.

It appears to us desirable to apply a durability test of this kind before "burning" mantles over a prolonged period, as obviously a mantle which is not strong is less useful than one which, though strong, gives an inferior light. From each batch of twelve mantles, three are tested for durability on the Woodall-Moon machine. If any of the three fail to survive 1000 shocks administered at the rate of 300 a minute, using 2-oz. weights (or 3000 at 600 a minute with 3-oz. weights for inverted mantles), three more are tested; and if the average strength of the six is represented by a figure less than 1000 (or 3000 for inverted mantles), no further tests of any kind are made. No upright mantle is tested above 1200 shocks a minute, and no inverted mantle above 3600 shocks. This test allows one mantle in six to fail absolutely if the other five survive 1200 or 3600 shocks each. As some mantles will stand more than 10,000 shocks, it is obviously undesirable to allow one unusually strong one to compensate for the entire or the partial failure of the rest; hence the limit of 1200 or 3600 shocks. This serves as a weeding-out test as well as an indication of the strength of survivors; and, as showing the advisability of applying a test of this kind, it may be mentioned that we have on many occasions obtained figures much below 100 as the average of six mantles from a single batch; while individual mantles have frequently broken down after only three or four shocks. From those batches which had passed the shock test, three fresh mantles are tested photometrically. The three or more which remain are available in case a mantle is accidentally injured.

PHOTOMETRIC TESTS.

The mantles for photometric tests are fitted on suitable burners. For the "C" pattern, we use Bray's "1906 C" burner, which has the advantage of an air adjustment; but any other "C" pattern could be used. After the mantles have been properly burnt off, gas is allowed to burn for 100 hours, and the mantles, on their burners, are then removed to the photometer-room which is close to that in which the burning is conducted. A 10-candle Harcourt pentane lamp is used as the standard of light, and a Leeson star disc, as modified by Dibdin, has been found satisfactory for purposes of comparison. We have found that new workers, on seeing the different colours of the lights on either side of the disc, have declared accurate comparison impossible, and have forthwith proceeded to obtain readings which agreed well within themselves and with those of other workers. A secondary incandescent standard, as designed by Carpenter and Helps, is considered more satisfactory; but we have no reason to abandon the direct use of the pentane lamp. The calorific power of the gas used by us, which is regulated by Statute, is fairly constant (about 120 to 125 calories per cubic foot).

We usually test mantles at the following rates of consumption, which approximately correspond to the working pressures indicated, and are normal for the respective burners.

Burner and Mantle.	"C."	Kern.				Inverted. Large Size.
		1.	2.	3.	4.	
Cubic feet of gas per hour .	3·5	2·0	3·0	4·0	5·5	4·0
Pressure in inches of water at nipple of burner. . .	1·2	1·8	1·4	1·6	2·1	2·3

The horizontal value is taken for all upright mantles on a 60-inch Letheby bar photometer; four readings being taken at equal angular intervals round the burner. For inverted mantles, Sugg's radial photometer is employed; three readings at each of the vertical angles 0°, 45°, and 90° being taken.

Some doubt having been felt as to whether tests made at a fixed rate of consumption, even when the air supply was adjusted, would give the same results as tests made at the maximum illumination attainable at ordinary pressures, a series of experiments was carried out with five different brands of "C" mantles. The results are summarized below:—

Duty—i.e., Candles per Cubic Foot of Gas Burnt.

	At 3½ Cubic Feet per Hour.	At 5 Cubic Feet per Hour.
I.—Three mantles	18·30 ± 0·36	18·04 ± 0·22
II.—Three ,, ...	16·79 ± 0·36	16·59 ± 0·16
III.—Three ,, ...	17·08 ± 0·34	18·79 ± 0·46
IV.—Two ,, ...	19·30 ± 0·50	15·53 ± 0·73
V.—Three ,, ...	18·03 ± 0·54	18·36 ± 0·06

The averages of the two series are respectively 17·9 and 17·46, or, correcting for the weight of each series, 18·05 and 17·8. If IV. were to be omitted, as the mantles were not of the usual shape, the averages would become 17·55 and 17·94, and the corrected means 17·5 and 18·6. As, however, mantles do at times vary in shape, and as those in question gave a very good efficiency at the lower rate, and not a very bad efficiency at the higher rate, it appears fair to adopt the lower rate, more especially as from 3½ to 4 cubic feet per hour is the recognized normal rate of consumption for "C" burners under ordinary domestic conditions.

In considering the results of a series of testings on mantles of different makes, it is useful to decide on some numerical expression which shall indicate the relative merits of different batches. It will probably be found there are several sets having high average illuminating power with little variation between individual mantles. Others will have an equally high average illuminating power but greater variation between individuals; and others quite low illuminating power. It is not fair in such a case to take the average as the figure of merit, since to do this would be to disregard uniformity of lighting. If, however, the minimum is taken, difficulties of another kind occur. Various formulæ based on a desire to give weight to both average and uniformity break down in some cases. Two plans can be adopted with satisfactory results: (1) To eliminate all with an average below a certain figure, and then all above this with a greater variation between individuals than is considered desirable, and to judge those remaining on average only; or (2) to calculate for each set, or at any rate for all those which are obviously worth considering, the mean variation (V) by means of the formula—

$$V = \pm\sqrt{\frac{V_1^2 + V_2^2 + \ldots . V_n^2}{n(n-1)}}$$

where $V_1 \ldots V_n$ represent the variation of each mantle from the average, and n is the number of mantles examined. The comparison figure is obtained by subtracting the mean variation from the average; when three mantles are examined $\sqrt{n(n-1)} = 2{\cdot}45$. This method gives very useful figures for comparing all the members of a long series.

In applying either or both of these methods, it must be borne in mind that the number of mantles tested is not, and in practice cannot be, great, and that the experiments are not very exact. The relative prices of the members of a series will naturally have great weight in the final choice.

Sometimes changing a mantle from one burner to another very materially alters its performance, since the efficiency of a mantle depends very much on the coincidence of its outline with that of the cone of highest temperature of the flame, which will vary in shape in different burners of the same pattern; and it is advisable, when abnormal variation is shown, to re-test such mantles on other burners if possible.

Some experimental figures are appended, with the figures of merit calculated as above. In most of the results quoted, the mantles passed the shock test. The exceptions are those examined prior to our adoption of the Woodall-Moon machine; but these results are also included as showing the variations occurring in the illuminating power. In all cases the mantles were in good condition (*i.e.*, undamaged) after the 100 hours burning; the results

given for illuminating power being the best obtainable under ordinary working conditions, at the gas consumption stated :—

"C" Mantles.

	Illuminating Power.	Mean of Set.	Figure of Merit.	Duty—*i.e.*, Candles per Cubic Foot of Gas Burnt.
A	67·3 60·4 63·3	63·7 ± 2·0	61·7	18·2
B	58·9 60·6 59·4	59·6 ± 0·5	59·1	17·0
C	56·8 57·3 61·8	58·6 ± 1·6	57·0	16·7
D	67·5 63·5 67·5	66·2 ± 1·3	64·9	18·9
E	65·5 67·5 60·5	64·5 ± 2·1	62·4	18·4
F	57·3 65·3 59·5	60·7 ± 2·3	58·4	17·3
G	59·3 59·0 54·3	57·5 ± 1·6	55·9	16·4
H	64·0 52·5 58·0	58·2 ± 3·3	54·9	16·6
I	48·8 63·5 62·3	58·2 ± 4·7	53·5	16·6
J	63·1 52·9 67·1	61·0 ± 4·2	55·8	17·4
K	68·3 63·7 54·6	62·2 ± 4·0	58·2	17·8
L	67·3 63·8 58·8	63·3 ± 2·4	60·9	18·1
M	65·3 59·5 50·8	58·5 ± 4·2	54·3	16·7

No. 2 Kern.

	Illuminating Power.	Mean of Set.	Figure of Merit.	Duty—*i.e.*, Candles per Cubic Foot of Gas Burnt.
A	61·0 63·0 60·5	61·5 ± 0·8	60·7	20·5
B	56·8 50·9 54·4	54·0 ± 1·7	52·3	18·0
C	57·9 46·9 43·4	49·4 ± 4·4	45·0	16·5
D	60·3 57·1 48·6	55·3 ± 3·5	51·8	18·4
E	52·0 42·5 25·0	39·8 ± 7·9	31·9	13·3
F	58·3 48·8 58·0	55·0 ± 3·1	51·9	18·3
G	43·8 48·0 41·3	44·4 ± 2·0	42·4	14·8
H	39·5 44·0 49·5	44·3 ± 2·9	41·4	14·8

No. 3 Kern.

	Illuminating Power.	Mean of Set.	Figure of Merit.	Duty—*i.e.*, Candles per Cubic Foot of Gas Burnt.
A	76·3 77·9 75·0	76·4 ± 0·8	75·6	19·1
B	79·5 72·8 78 0	76·8 ± 2·0	74·8	19·2
C	78·1 80·4 75·1	77·9 ± 1·5	76·4	19·5
D	74·0 71·5 76·0	73·8 ± 1·3	72·5	18·5
E	82·5 79·0 78·3	79·9 ± 1·3	78·6	20·0
F	72·0 72·0 71·0	71·7 ± 0·3	71·4	17·9
G	77·0 74·8 74·5	75·4 ± 0·8	74·6	18·9

No. 4 Kern.

	Illuminating Power.	Mean of Set.	Figure of Merit.	Duty—*i.e.*, Candles per Cubic Foot of Gas Burnt.
A	112·9 107·9 116·5	112·4 ± 2·5	109·9	20·4
B	112·9 107·8 114·6	111·8 ± 2·0	109·8	20·3
C	103·8 98·0 101·3	101·0 ± 1·7	99·3	18·4
D	108·8 120·0 115·3	114·7 ± 3·2	111·5	20·9
E	105·3 102·3 109·8	105·8 ± 2·2	103·6	19·2
F	107·5 103·0 102·5	104·3 ± 1·6	102·7	19·0
G	102·5 113·8 107·3	107·9 ± 3·2	104·7	19·6
H	104·5 106·0 105·5	105·3 ± 0·4	104·9	19·2

MANCHESTER UNIVERSITY LECTURES.

The Fifth Lecture of the series arranged to be given at the University of Manchester, under the auspices of the Junior Gas Association, in conjunction with the District Institution of Gas Engineers, was delivered on Saturday afternoon by Mr. John T. Sheard, Chief Chemist to the Sheffield United Gas Company, who took for his subject "The Chemical Control of Gas-Works." Alderman F. S. Phillips, the Mayor of Salford, who is also Chairman of the Corporation Gas Committee, was announced to preside; but at the last moment he found it impossible to keep the engagement, and his place was taken by Alderman J. Snape, the Deputy-Mayor, and a member of the Gas Committee. He was supported by Mr. H. Kendrick (Stretford), the President of the Manchester District Institution of Gas Engineers, Mr. S. Meunier (Stockport), the Chairman of the Lancashire Commercial Section of the Institution, and Mr. F. Thorp, the President, and Mr. J. Alsop, the Secretary, of the Manchester and District Junior Gas Association.

Having explained that the Mayor of Salford had been unable to take the chair in consequence of other calls upon him in his official capacity, Alderman SNAPE said he was glad to find so many of the younger members of the gas profession taking an interest in the University lectures, and availing themselves of the opportunities afforded for obtaining a thorough scientific training in gas manufacture, as well as for carrying out research work. It was in this way that they would make more rapid progress than had been possible in the past. As a member of the Salford Gas Committee, he had had an opportunity of particularly noticing the progress made during the past twenty-five years in gas manufacture and appliances connected with it. Some of the changes had been simply marvellous; but he ventured to say that the last word had not yet been said in regard to the manufacture of gas and its uses for illumination and other purposes. Important as had been the discoveries in the past, he believed even more important ones would yet be made. In calling upon Mr. Sheard to deliver his lecture, he recalled the fact that this gentleman was formerly connected with the Salford gas undertaking.

Mr. SHEARD then delivered his lecture, which will be found on p. 373.

VOTES OF THANKS.

Mr. W. W. WOODWARD (Salford), in moving a vote of thanks to the lecturer, said the remarks made by Mr. Sheard on the evaporation of ammonia reminded him of an article written by the same gentleman which was published in the "JOURNAL OF GAS LIGHTING" as far back as 1883 [Vol. XLII., pp. 315, 444], though those present, looking at Mr. Sheard, would scarcely credit him with being old enough to have done it. In that paper, Mr. Sheard shed considerable light on the subject; and they had just had the advantage of hearing the results of his further researches in the same direction, besides having had brought before them other important points in connection with the chemical control of gas-works.

Mr. A. L. HOLTON, President-elect of the Junior Association, seconded the motion. He said the lecture would not be the least important of the series which had been organized, especially when it was remembered that these lectures would be regarded as a kind of text-book to them, to be referred to; and seeing that chemistry was becoming increasingly prominent in gas manufacture, this lecture would be even more important as time went on.

The CHAIRMAN, before putting the motion, said he had been greatly interested in the lecture, which had confirmed what he said at the commencement of the proceedings—that we had not heard the last word in regard to discoveries in the manufacture of gas and the methods of its application. The lecturer had shown that there was still room for research and scientific work

on these questions, and he (Alderman Snape) was glad to say that the Salford Technical Institute, of which he was the Chairman, had established classes for gas students. There were also classes at the Manchester School; and he rejoiced to know that now the Manchester University provided facilities for further study to gas engineers and students, so that they might get to the very forefront in this matter. He had no need to tell those present that more scientific training was required in these times. The old days of working by rule-of-thumb had gone by; and they must set themselves to acquire knowledge and apply it to their work, whatever it might be.

The motion having been carried with applause,

Mr. SHEARD briefly replied.

Mr. W. HILL, in moving a vote of thanks to Alderman Snape for presiding, said he had no doubt if the Junior Gas Association were to carry on these lectures, they would get some real support from those who had the control of gas undertakings. He hoped that, when the time came for them to have to ask for this support, their case would receive at any rate fair consideration.

Mr. S. CARTER seconded the motion; and it was carried with hearty applause.

The CHAIRMAN, in reply, said there was one matter to which he would like to draw attention. As he had said, there had been wonderful progress made during the last twenty-five years in the processes of gas manufacture; and greater progress would, no doubt, be made in the next quarter-of-a-century. All the improvements made were in the direction of producing gas at less cost and with less labour. It was so in other industries.

This concluded the proceedings at the University; but the members of the Junior Association subsequently had their customary meeting to discuss points raised by the lecturer.

SOCIÉTÉ TECHNIQUE DU GAZ EN FRANCE.

Extended Scope of Operations.

With the notice informing members of the French Gas Society that the annual meeting this year will be held at Marseilles on May 22 and following days, there is sent an important statement, signed by the President, M. Marquisan, recording a very interesting development in the scope of the work of the Société Technique du Gaz. The Committee of the Society decided on Oct. 3 last to establish under its care, different permanent commissions (or committees), the object and duty of which are set out as follows:

1.—They will supply to members, upon their request and as occasion may arise, technical information which may be required to help them to solve professional difficulties, which may be met with in the conduct of their works. This proposal as to technical matters is somewhat analogous to what is done in commercial affairs by the corresponding gas association in France known as the "Syndicat Professionnel."

2.—They will receive papers from members to be read at the annual meeting, and will be at the service of members desiring further information so as to complete their papers.

3.—Each commission, according to its jurisdiction, will make arrangements for the annual meeting either by way of preliminary work, or in the guidance of the discussions. Each commission will present to the congress a report on its work for the year, and also, if possible, one or two papers of a general character on questions within its scope.

4.—Further, if financial means and other circumstances allow, they will carry out or conduct tests on particular matters, or act so as to lead up to, and encourage, them.

The statement goes on to say that, by establishing these commissions, the Committee thought that, from various points of view, they would be able to be of assistance to a large number of members, by offering them advice, and by instigating them to send information of a practical kind, especially in connection with the management of average and small works—such as a description of overcoming difficulties which are not of everyday occurrence. Moreover, it will be endeavoured to make the annual meetings as instructive and as useful as possible, by bringing forth advanced or elementary papers (the latter being often not the less serviceable), with a view to interest the majority of the members. Those members who have thought of any novel arrangements or interesting methods of working, and who have so far hesitated from making them the subject-matter of papers, will, it is hoped, be encouraged to bring them to the notice of their colleagues.

The scope of the five Commissions or Committees, and the members composing them, are as follows:—

(1) COMMITTEE RELATING TO MANUFACTURE.

MM. Boutan, Guillet, Koechlin, Kaeuffer, Laurain, Villiers.
President: M. Boutan.

(2) DISTRIBUTION COMMITTEE.

MM. Bachelay, Bigeard, Delebecque, G. Gautier, Koechlin.
President: M. Delebecque.

(3) COMMITTEE FOR GAS (AND OTHER) LIGHTING, HEATING, AND POWER.

MM. R. Ellissen, Masse, Monthiers, Rouland, Seguin, G. Gautier.
President: M. Rouland.

(4) TECHNICAL INFORMATION COMMITTEE.

MM. Bouvier, R. Ellissen, Frère, Gardiner, Laurain, Masse.
President: M. Laurain.

(5) COAL ANALYSIS COMMITTEE.

MM. Bouvier, Delebecque, Guillet, Laurain, Lemerle.
President: M. Delebecque.

FACTORY LIGHTING REQUIREMENTS.

By JOSEPH NEWMAN, Jun.

[Extracts from a Paper presented to the American Illuminating Engineering Society.]

The keynote of the modern factory system is efficiency; and efficiency is greatly aided by keeping production at its maximum during the entire length of the working day. Those who are familar with factory conditions know how great is the tendency of production to slacken as the hours of darkness approach; thus lessening the total output and decreasing the shop efficiency. In some measure, this slackening may be due to the fact that the average human being cannot maintain the maximum pace for the standard factory day of ten hours. The other most potent reason for this falling-off is, in the majority of shops, the difficulty of approximating daylight conditions by means of artificial light. The development of more efficient methods of lighting has been coincident with the increasing pressure of higher labour and material costs in all lines of manufacture. Lack of light has undoubtedly caused a large amount of waste human energy and of material. As labour has become more valuable and more independent, the comfort and well-being of employees have been seen by the more broad-minded to create a valuable asset in the lessening of these class differences which cause so much economic waste. Well-lighted, well-ventilated shops make for peace of mind, and are very important factors of an efficient organization. Another reason for insisting on the economy of good lighting is the bearing it has on the accident account. As it is perfectly feasible to eliminate accidents due to lack of light in workshops, it should be done from a humanitarian and conservation standpoint.

It has become axiomatic in the mercantile world that the best possible lighting is a very valuable asset; and the idea has slowly percolated down to the shop. The factory manager is now asking for good light, and how it may be obtained at a reasonable cost. When he asks for good light, he means such light as will prevent accidents and keep the rate of production in the shop as high as it is during the hours of daylight. If attention is concentrated on the latter consideration, it will invariably be found that prevention of accidents has been cared for at the same time.

It is appropriate to take the different parts of a shop in turn, and consider their requirements—commencing with the foundries, and following the processes in the shop to their completion, and the storage of the machines in the warehouses.

In foundries, where the larger castings are made, the lighting must be fairly even, avoiding dense shadows. But the intensity need not be great. Buildings used for this class of work are always provided with cranes, and lamps must be hung high to avoid them. This means units of high candle power, and enough of them to overcome the great absorptive power of the black moulding sand. For small castings, not only must good general illumination be secured, but each moulder must be supplied with a small unit at his bench or stall for the accurate setting of cores and finishing moulds. This is especially true of malleable foundries, where the castings are thin and of intricate design. As a general rule, the benches are so arranged that the moulder works with his face to the wall, and the light comes over his shoulder. The intensity required is so great, and the amount of space occupied per man so large, that it is impracticable to raise the general lighting sufficiently to do away with hand lamps. It is also impossible to change the position of the moulding floors. In all cases of this kind, the lighting must conform to the other requirements of operation; it being one of the conditions of every single lighting problem in a factory that the plan of the shop is fixed, and the lighting must be arranged to suit the plan.

Malleable foundries require a larger amount of general illumination than do those in which grey iron is made, as, on account of the method of pouring and the high temperature of the metal, great quantities of steam and smoke arise from the moulds, which in cold and humid weather make adequate lighting almost impossible. This condition lasts only a short time during the latter part of the heating, and as the moulds are cooling; but unless the ventilating conditions are exceptional, the fog is dense. In foundry work, where no help can be obtained from reflecting surfaces, it is necessary to expend enough energy to furnish from half to one candle power per square foot of floor area, depending on the height at which it is required to hang the lamps and the amount of smoke and vapour generated. For heights less than 20 feet, units of 300 or 400 candle power, with good reflectors, give the best results.

In machine-shops, where general cleanliness can be maintained, a smaller expenditure of energy than in foundries will give good results. The work must be well lighted; but the general surroundings do not need a very high degree of illumination. An expenditure of energy resulting in the lighting of 4 square feet per candle power will, with good reflectors, be sufficient, if the light is well

distributed. This means from 0·5 to 1·5 foot-candles on a plane 30 inches from the floor; lamps being hung 10 ft. 6 in. high.

The machine-shops I assumed are those where most of the parts are small—ranging in size from 1 lb. to 100 lbs.; and the operations are of a more or less simple nature, such as drilling and facing and the simplest kind of lathe work. Lamps of comparatively small size seem best suited to these conditions; 80-candle power being a convenient unit. Where lamps of twice this size or larger have been tried, a far greater number of 8-candle and 16-candle lamps must be installed to give the desired results. This increases the first cost of the equipment, and also the maintenance cost. Large enamelled intensive shades are the most useful, as wide variation in light between the lamps is not objectionable; and in order to get the best results as economically as possible, it is necessary to place the lamps at irregular intervals, concentrating the light on the work and tools, except in the main gangways. Lathes are practically the only machines of this type which require individual lamps. Where punching and forming presses are used, each machine must have one or more small lamps on some form of adjustable fixture, as the work and dies cannot be fully reached by any general scheme of illumination. Lamps of the 8-candle size seem to be best suited to this class of work, with the 80-candle lamps under shades for general lighting.

Wood shops are easily lighted by the judicious placing of intensive units over the machines. In paint shops, where the results wanted are broad, and considerable dipping is done, the illumination needed is no greater than in machine-shops. In warehouses, which are only used for storage, a very low intensity is all that is required, except along the main gangways where there is much traffic. Lamps of 16-candle power, spaced 16 feet apart, under flat shades, answer very well. These lamps should be hung as close to the ceiling as possible, so that the stock may be piled up almost to the roof girders. An evenly distributed light is what is needed; the most important point in a case of this kind being that the light shall always be ready for use when wanted.

The lighting of a factory is a comparatively simple matter. The chief feature, to which all others must be subordinated, is reliability; simplicity is the second; and cost of maintenance the third. Simplicity and reliability are usually found together. It is understood that the conditions considered above are those of a plant already in existence, with a lighting system installed, and that the discussion relates to methods of bringing it up to what is considered a modern standard. First cost is often the determining factor when the necessity for a change in the lighting system has made itself apparent. This is especially true when reliability and simplicity are combined with low first cost, as against alleged low cost of maintenance and energy. In fact, the making of improvements and replacing worn-out apparatus without expending more than the amount usually set aside for maintenance is the condition which has to be met as nearly as possible.

To sum up, in the light of past experience, the factory needs a lighting system at a minimum first cost, even at the sacrifice of some efficiency. It needs a system which will give 24-hour service with a minimum of unintelligent attention. It needs a unit which will fit naturally into the divisions of shop space made by the post-supported mill construction. It needs a large percentage of the light concentrated on the machines and work, but enough light in all parts of the shop area to make movement as safe and free as under daylight conditions. The problem is not difficult to solve if attended with the same energy as is given to lighting the goods on sale after manufacture.

Composition of Gas in Very Hot Flames.—In a paragraph on this subject in "La Nature," it was stated that the products of combustion of gases in very hot flames are not always identical with those generally met with. Thus it has been shown that in the presence of an excess of oxygen the combustion of carbon monoxide gives ozone; under the same conditions, the hydrogen flame also contains ozone and a little nitrous oxide; and, further, the acetylene flame contains almost 4 per cent. of this same nitrous oxide. The temperatures attained during the combustion of these gases, under the above conditions, are exceedingly high—about 2600° C. for carbon monoxide, 2800° C. for hydrogen, and 3000° C. for acetylene.

Vienna Municipality and the Gas Supply.—At the last meeting of the Imperial Continental Gas Association, the Chairman (Mr. J. Horsley Palmer) announced that, as from the end of the present year, the active operations of the Association in Vienna will come to an end. The Association have two businesses in the suburbs of the city; the larger one being on the right, and the smaller one on the left bank of the Danube. The concession for the former expires this year, and the business will then be taken over by the Municipality; and the Association deemed it desirable that an arrangement should be come to by which the works supplying the smaller area (which contains a number of communes not long since incorporated in the city) should also be transferred. As announced by the Chairman at the meeting alluded to, the negotiations were brought to a successful issue; and according to a telegram which appeared in the London papers last Thursday, the Municipal Council have agreed to the purchase. The City buy, at a valuation, the whole of the plant and materials outside the works—*i.e.*, mains, services, meters, public lamps, &c., and pay about £29,000 as compensation for loss of profits; but the valuable sites occupied by the works and offices remain in possession of the Association.

LIGHTING OF PUBLIC LIBRARIES.

The Art of Serviceable Illumination.

The discussion on the above subject that was commenced a fortnight previously was continued at the meeting of the Illuminating Engineering Society, at the Society of Arts, last Tuesday. It will be remembered that the members of the Library Association united with the members of the Society in considering the subject, which was introduced by papers prepared by Mr. J. Duff Brown, the Public Librarian of Islington, Mr. J. Stanley Jast, the Public Librarian of Croydon, and Mr. John Darch, representing the architectural profession. From the papers, the illuminating engineers secured much information as to the requirements of the librarians.

Mr. P. Blagg sent a written communication which was read to to the meeting by the Hon. Secretary (Mr. Gaster). In the course of it, he remarked that if reading-rooms were always full, he saw no reason why they should not be illuminated by a general system of lighting. He entirely dissented from the use of arc lights for general illumination in such places. They were too fluctuating for general reading, and should be discarded from the British Museum on account of the noise they made. Local lighting was no doubt necessary in addition to the general lighting; but he feared the public were more in the habit of turning on such lights than they were of turning them off. From his study of the question of local lighting, it seemed to him there were 99 wrong positions for every right one. But the difficulty of the lighting contractor was to get information before starting on his work as to the future disposition of furniture and other matters that entered into the problem.

Mr. W. S. C. Rae (Fulham Library) questioned whether the ideal conditions of lighting suggested by lighting experts and architects were always the most practical. For instance, he noticed in a diagram exhibited by Mr. Darch at the previous meeting an ideal method of lighting a reading-stand that would subject the lamp and shade to damage by the reader. With regard to shelf lighting, he also doubted whether the extra expense involved in getting to the ideal on the bottom shelves was altogether justified.

Mr. Haydn Harrison thought the lighting of libraries ought to be divided into two parts. One was the lighting of the library, and the other the lighting of the tables for people who wanted to read the books. The problems were quite different, and should be treated separately. In regard to the lighting of the shelves, he had little to say, except in respect of Mr. Jast's suggestion that lamps should be placed in a trench in the floor with a glass cover. This seemed to him (Mr. Harrison) to be a complicated way of carrying out the lighting of the lower shelves. Personally, he should deal with it by placing lamps in the gangway with suitable shades; and he should prefer to use a white drugget or cloth on the floor to reflect the light on to the bottom shelves. To this there could be no serious objection. The drugget could be easily cleaned; and it would be an advantage from the sanitary point of view. The question of providing illumination for reading and consulting the contents of the library was a very interesting subject. Reading was one of the most trying occupations for the eye of which he knew. Therefore, it was essential that the illumination of the literature to be read should be at any rate above a certain degree. In many libraries with the illumination provided, the reading of the literature would eventually result in deterioration of the optic nerve. This was because the problem had been tackled by attempting to take the general lighting as the actual light required on the books that one wanted to read. The two things must be left absolutely separate. In a private room, if one was in the habit of reading and writing a great deal, one learned by experience that it was much better to have a light on the table, none of the rays of which light could get into the eye, and to use a small general light so as to see one's way about. He should prefer to deal with library lighting in precisely the same way. The tables on which books or papers were laid should be provided with separate lights; and he would arrange them all with shades, so that the reader or writer would have to put his head in an awkward position to get any rays of light into his eyes. Of course, people would immediately come forward and say that they could not afford to do this, because it would mean a separate light for nearly every reader, and would necessitate a very small light. A 10-candle power lamp at a distance of 2 feet from where one was reading was better than a 50-candle power one at a distance of 12 feet away. They must find a small light unit that could be used for this purpose. The proof of benefit was that our forefathers who used candles did not suffer from eye trouble as people did in the present day. In library lighting, the individual unit of light should be attempted; and it was nearly always capable of being carried out with a little ingenuity. Concerning the general lighting, it was a great pity the books themselves must be in the same room as the reader, because they necessitated general lighting a great deal more than the reading. But these lights could be shaded if the lighting was carried properly into effect. When they had before them the results of the experiments Mr. Dow had made at libraries, they ought then to get at something approximate as to what was necessary for reading and writing. Some said 1 foot-candle was necessary for the purpose; whereas it would be found in many cases where reading was going on that the illumination was greater than this—pro-

bably 3, 4, or 5 foot-candles. The amount of illumination could no doubt be too much. Shiny surfaces of paper would reflect the light back into the eyes and cause trouble. If 1 foot-candle was enough, one would probably argue that 10 foot-candles was too much. He therefore hoped the Society would, one of these days, be able to come to some agreement as to what was about the right illumination for reading and writing purposes.

Mr. J. H. Quinn (Chelsea Library) said, in connection with library lighting, the illuminating engineer was not often called in. This was on account of the penny rate. For some years now, since 1891 at any rate, they had been groping after an effective light for the Chelsea Library. They had to find their own money; and therefore had to do the lighting in as effective a manner as possible at a cheap rate. They had tried arc lamps for general lighting; but during late years they had found considerable satisfaction with the Nernst light. It was economical so far as the consumption was concerned, but very uneconomical in regard to the use of the lamps. They were now lighting the whole installation with metallic filament lamps; and compared with the former conditions, they had plenty of light at a small cost for current and for lamps. In 1906, they paid £194 16s. for current, and the next year £177. In 1909, the bill was £157; and in 1910, £135. The light available had been doubled; and the cost of the current had been reduced with the metallic filament lamps. In 1907, they paid £20 for renewals; and in 1910, £4 18s. 8d. He had strong views as to making, through the lighting, public reading-rooms counter-attractive to public-houses. In reference to local lighting on the tables, he found, generally speaking, most people did take care to turn off the lamps after finishing with them.

Mr. Ritchie thought that inverted, or reflected, lighting had many advantages for the general illumination of the portion of libraries in which books were housed; and the system gave a good deal of flexibility in the disposition of the furniture. He demonstrated, too, by lantern slides, that this system of lighting was also good for lighting gangways. There was the difficulty that, under this system, the light had to be provided when the reading-room was not fully occupied. But he thought that reading would be done under such pleasant conditions that there would be a very large gravitation of the public to the reading-room.

Mr. V. H. Mackinney spoke of the improvement in the lighting conditions, principally by obtaining greater uniformity, that had been effected in various libraries by the application of holophane globes, to direct the light where it was required, on tables and book-selves. He also stated his preference for general lighting, supplemented by local lighting. The Engineer of the Holophane Company, he also mentioned, was engaged on a curved reflector [a diagram of which he showed], whereby the illumination of flat surfaces would be secured.

Mr. V. G. Middleton, speaking of reflected lighting, said it could be used under suitable circumstances; and those circumstances were invariably absent from buildings with which he had been called upon to deal. He should like to know how the cost of inverted lighting with arc lamps compared with inverted lighting with metallic filament lamps. It seemed to him the use of arc lamps for the purpose of lighting a library must entail a considerable addition to the cost of the current. But it was their duty to see that, whatever the character of the light employed, it must not be injurious to the eyes. Practically in nearly all the photographs thrown upon the screen, it was seen that the general lighting was exposed to the eye. This must be unsatisfactory, because the moment one looked at an exposed lamp, the eye became affected. More care should be taken to shield the light from the eyes, and to make the general lighting a subsidiary portion of the lighting of a room. It seemed to him this must be the order of things in a room devoted to reading. With regard to local lighting, the desirability of being able to vary the strength of the light was referred to at the former meeting. Some eyes, of course, needed a more powerful light than others. The correct thing was to have the weakest possible light. It strained the eyes less. It would also be a good thing to have the local light on a standard, which could be made to rise and fall. In his view, contractors must look to the architects to be more positive in their requirements when they invited them to tender for lighting installations.

Mr. H. V. Hopwood (Patent Office) remarked that this subject of the lighting of public libraries, raised two or three questions: What did the public want in regard to light? and how was the architect going to supply it? And after the architect had supplied it, how was it to be altered? The last was an important point, as they had found at the Patent Office. He referred to some trials that had been made at the Patent Office with an eye to ascertaining whether improvement could be made. In his opinion, what was wanted was information as to the minimum amount of light a man required to read by; and how much light he required if he was puzzling out a reduced drawing in an engineering paper. He should like to see a specificatiom drawn up that for reading one wanted so much light; for examining a drawing, so much; and for lighting a book-stack, so much. But every librarian had to fit his light to his conditions.

Mr. W. W. Topley (Croydon) said he had been a little disappointed that so many of those who had just spoken on this subject were of opinion that diffused lighting was a matter which had to be considered only for finding one's way about a library, and that, for the actual purpose of reading, it was a thing to be avoided rather than otherwise. He disagreed entirely with this view. In the remarks at the last meeting, their President very clearly and rightly laid it down that discussion of different sources of illumination did not come within the purview of the Society. There was, however, one source of lighting it was impossible to leave out of consideration—daylight. Daylight should be made use of to the greatest extent in both the general lighting and on the working surfaces; and, when any rearrangement of a library was desirable, a librarian, if he had any voice in the matter, would see to it that he so arranged the contents as to make the utmost use of daylight. When daylight failed, the methods adopted should be those utilizing to the greatest extent diffused lighting. Mr. Jast, in his paper, made reference to an actual experiment with diffused lighting in the magazine room of the library for which he was responsible at Croydon. It was a room probably 45 ft. by 30 ft. by 14 ft. high. It was formerly very unsatisfactorily lighted. In the course of some rearrangement, the walls were coloured light; and the sole source of illumination was sought for in a number of lamps with reflectors placed close to the ceiling, so that practically no direct rays fell upon the eyes. The room was satisfactorily and economically lighted; and he believed, in the opinion of those who used it, the lighting was of a desirable form. Indirect lighting, in his view, was a good thing where it could be obtained. Regarding the relative positions of general and point lighting, in his judgment diffused lighting should do the greater duty, and point lighting should be reduced to the smallest possible limits.

Mr. J. S. Dow read a communication from Mr. Waldram on the subject of daylight illumination.

Mr. Justus Eck remarked that a great deal had been said about the intensity of light, but not so much consideration had been given to the quality of the surface of the paper from which one might be reading. His experience was that it was very trying to read by artificial light from paper having a glazed surface; and in connection with the modern growth of the use of glazed surface paper, he thought the question of the use of indirect lighting required the greatest consideration. Those who had had experience at book work or drawing by indirect lighting would agree with him that there was no other form of artificial lighting by which one could continue to work without feeling fatigue.

Mr. Darch (one of the authors of the papers read at the previous meeting), in replying upon the discussion, remarked that nearly all he had said in his paper had been confirmed by one or other of the speakers. Mr. Hopwood asked what would be a proper allowance in foot-candles for reading. If they had a lamp that could be raised and lowered, he should say that at least 2 foot-candles and at the highest 12 foot-candles would be a proper range for a fair average and useful light. Some people might say that 12 foot-candles was too much; but those who had worked on a fine drawing with a hard pencil would find it was not so. For book reading, this quantity of light would be too great. That was why he recommended movable lamps within the control of the reader. As to indirect lighting, one could not say it was going to cure everything. Direct lighting was much cheaper than indirect; but where the latter could be used, it was undoubtedly the better. Mr. Jast and other gentlemen spoke of having general lighting answer all purposes. He (Mr. Darch) thought that would be a mistake, and would be very expensive. To get 5 foot-candles over a table it might be necessary to have the source over the table of some 250-candle power. General lighting should be very moderate. One gentleman had said 0·1 foot-candle would suffice. This would be a very low figure. In his paper, he recommended 0·75 foot-candle. He believed that was a good quantity; but circumstances would vary it.

Mr. Jast, in a written communication, said he did not think it was practicable in a public establishment for them to have to cater for the idiosyncrasies of people. But they should consider the physiological needs of the normal eye in regard to illumination in connection with reading. People wanted more illumination now than a couple of decades ago; and the eye was continually demanding more and more light. Adequate investigation of this subject had not been made; and until it was, they were not on the threshold of a scientific standard for the purpose. One was justified in concluding that, to supply more light to the eye than it really needed, was to do the eye an injury.

Mr. Duff-Brown observed that there seemed to be a great deal of general agreement among them that the nearer they got to daylight in their artificial lighting methods, the better. Local lighting, in his opinion, was quite a mistake. Of course, architects were not lighting experts, and that was where trouble came in. On the whole, he thought the discussion had been profitable. He should like, however, to suggest that an attempt be made to fix upon a normal set of conditions for the lighting of libraries, by the appointment of a joint committee, consisting of lighting engineers, architects, and librarians so as to consider the matter on a scientific basis.

The next two meetings of the Society will be devoted to the subject of school lighting. The papers will be read at a meeting on Feb. 16, when medical men will be invited to discuss them; and at a succeeding meeting, the discussion, it is proposed, shall be continued by gas and electric lighting engineers.

Dutch Association of Gas Managers.—We learn that the President of the Association for the current year is Heer J. W. H. Bauduin, of Maastricht; and that the Secretary is Heer N. W. van Doesburgh, whose address is Rynsburgerweg 6A, Leiden.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Liverpool Corporation and the Standard Burner Bill.

SIR,—In an article in last week's issue of the "JOURNAL," p. 281 (also in an article in your issue of Oct. 6 last), you make reference to the action of the Liverpool Corporation in opposing the Standard Burner Bills, and the subsequent move of the Corporation in applying for permission to use the No. 2 Metropolitan burner for their own works at Fazakerley.

This action on the part of the Corporation you have stigmatized as "inconsistent," "repentant," and attempted generally to expose the Corporation and their advisers to ridicule. You now follow this up by expressing admiration for the wisdom and boldness, you say, the Corporation are now displaying.

As I was myself in a measure responsible for the attitude of the Corporation, I give you, in the first case, the direct denial that the Corporation were ever opposed to the Liverpool United Gas Company substituting the No. 2 Metropolitan argand for the No. 7 standard flat-flame burner. The Corporation were aware that the proposed change in standard test-burners meant, in fact, a reduction in the illuminating power of the gas. The Corporation were further aware that the standard of quality of the Liverpool gas—*i.e.*, 20 candles in the No. 7 standard flat-flame burner—was a high one; and at the outset they accepted my view that the illuminating power might be reduced from 20 candles in the No. 2 Metropolitan argand, provided that the saving effected by the Gas Company, in the process of manufacturing the lower quality gas, was given to the consumers in reduction in price as compensation.

This was fully set forth in the opening speech of Mr. Talbot, K.C., before the Lords' Committee, when he pointed out that what the Corporation required was a money equivalent to compensate the consumers for something that was going to be taken away.

The Gas Company have not denied that the proposed change in the standard test-burner meant a reduction in the illuminating power of the gas, and have also readily admitted that some saving in the cost of manufacture would accrue, consequent on the reduced candle power.

The Gas Company, however, were unwilling to entertain any question of reduction in price. They put forward the view that, as they were a maximum-price Company, all the saving effected in cost of manufacture would automatically revert to the consumers in reduction in price; and they desired that the time and amount of the reduction should rest with themselves alone.

The Corporation very properly objected to be party to a one-sided bargain of this sort; and to try and enforce some measure of justice for the consumer, they set up opposition to the Bill. As a result of this opposition, the Gas Company conceded a reduction of 1d. per candle reduction in illuminating power. In other words, the price is reduced by 2d. per 1000 cubic feet; and while the No. 2 Metropolitan argand is to be used, the Gas Company agreed to retain the use of the standard flat-flame test-burner also, and have undertaken to supply gas of 18 candles as ascertained in the latter burner—thus securing the supply of a gas reduced by 2 candles only. I, therefore, state that had the Gas Company come forward at the outset with the terms they finally agreed to, the Liverpool Corporation would not have opposed the Bill.

With regard to your charges against the Corporation of "inconsistency" and "repentance" in having themselves applied for powers to use the No. 2 Metropolitan burner, I say these charges have no foundation in fact. When the Liverpool Corporation constituted themselves the Gas Authority in Fazakerley—notwithstanding that this was a small and undeveloped district in which there would be for a considerable time very little gas consumption—they determined to place themselves in line with the Gas Company, and compete with them as near as they possibly could, in both the matters of illuminating power and selling price; and in applying now for powers to supply 20-candle gas in the No. 2 Metropolitan burner, they are consistently continuing the policy they commenced in their endeavour to compete with the Company.

Your remarks in last week's article about "dreadful things that were going to happen to the gas consumers of Liverpool, and elsewhere," also "your shuddering for the future of the consumers of Fazakerley," are covert sneers at the evidence I gave as to the effect of low-grade *versus* high-grade gas for motive power, which evidence was the subject of the strongest possible adverse comment by Mr. Honoratus Lloyd, K.C., in his closing speech before the Lords Committee.

However, neither your sneers nor the derisive words of Mr. Lloyd, to the accompanying approbation of the great assemblage of promoters, alter the facts of what I stated on that occasion, which evidence, when repeated before the Commons Committee, was left severely alone by Counsel for the Bill! I have, however, no doubt but what the latter incident escaped your notice—just in the same way that the Craven Street standard burner comparison test did, when I succeeded in establishing a difference of 4·7 candles between the No. 1 London and the No. 2 Metropolitan burners, after the three days of hard swearing by the promoters that there was little or no difference, and (*vide* Professor Lewes) with 16-candle gas the two burners gave identical results.

Having offered this explanation with regard to the position of Liverpool, I would, while on the subject, say a word on the general policy of low-grade gas so persistently advocated, and introduced in some districts of late. When I say low-grade gas, I refer to 14-candle gas as ascertained in the No. 2 Metropolitan burner, and venture to assert that the supply of this quality gas is inimical to the best interests of the gas industry.

I do not, and never have, advocate excessive enrichment; but how much this new 14-candle gas is inferior to what ordinary gas-works have hitherto been used to manufacture, even without the use of any enrichment whatever, is best described by Mr. Carpenter in his speech on Feb. 9, 1909, to the shareholders of the South Metropolitan Gas Company, when he is reported to have said:—

> "The basis of our working is, as you know, to supply gas of 14-candle power. We got permission to come down to that quality some years ago, on account of, among other reasons, the increasing use of gas for other purposes than direct illumination. And while the average quality of gas which we are able to supply by our present method of manufacture is about 16·4 candles, the average we should supply, if we knew how to do it, would be 14·4 candles. Unfortunately, we do not know how to do it. As manufacturers of gas, we have exhausted our efforts to introduce a 14·4-candle gas."

This will convey very forcibly to the lay mind the kind of gas this particular 14-candle quality must be, when a gas-works manufacturing coal gas only is unable to get down to it. So that it is only those gas-works possessing water-gas plants that are in a position to dilute the quality of the gas down to so low a grade as 14 candles in the No. 2 Metropolitan argand.

I have looked in vain in your editorial and news columns for some reference to the chaos that followed the introduction of this low-grade gas by the Dublin Gas Company, which was severe and wide-spread in its effect. In other centres, stagnation is being brought about by its introduction—making a fine harvest for our electricity competitors, who are winning over consumers with much greater ease in the low-grade gas districts than they are in districts where the gas of economical quality is supplied. So that I can well understand that the appeal for funds by the Publicity Committee is, from some quarters, heart-felt and sincere. But in my opinion something more than "advertisements, posters, and booklets" will be required if the "rot" arising from the supply of low-grade gas is to be stopped.

I would add that I am just as anxious as you, Sir, or as any of the promoters of the Standard Burner Bill, for the welfare of the gas industry, and my conviction is that I can best foster that welfare by continuing my present practice of supplying a gas that is considerably in excess of 14 candles in the No. 2 Metropolitan burner.

Widnes, Feb. 4, 1911. ISAAC CARR.

[If readers of Mr. Carr's letter will cast their minds over the controversy of the last few years, will consider among other things the number of undertakings that have adopted the 14-candle power standard, will consider the position of the gas industry as revealed by the last-issued Board of Trade returns in the matter of the volume of business done, the manufacturing economies that have been effected, the reductions of price that have been made, and the better position that the gas industry is in to-day to meet competition, then it will relieve us of the necessity of dilating at length upon several of the points raised by our correspondent. It is only necessary to touch on two or three of the points. Mr. Carr has apparently overlooked the statement in our editorial columns on Nov. 29 last regarding the terms of the Liverpool agreement, where the reduction of price was mentioned, as well as the point as to supplying gas of 18-candle power as tested by the flat-flame burner. Apparently looked upon by Mr. Carr as insignificant, as he does not deign to mention it, is a time-limit to the reduction and to the condition as to quality and the test; and the reduction is accompanied by protection in the shape of a provision as to coal prices. This is an extract from what we said on Nov. 29:

> The main head of the agreement is the concession on the part of the Company of a reduction of 2d. in the price of gas as from March 31 next; *and this reduction is to continue for two years.* Of course, the interests of the shareholders have been fully protected, as is necessary in these days of a perennially agitated and uncertain coal market. The condition attached to the reduction is that the price of gas may be advanced or decreased by 1d. per 1000 cubic feet for every shilling rise or fall as the case may be in the price of coal. . . . *During the two years* that the terms as to price are to be maintained in Liverpool, the Company are under promise not to allow the illuminating power of the gas to fall below 18 candles, tested by the flat-flame burner.

The reduction is no more than would, we think there is no doubt, have fallen to the consumers without any agreement. In our opinion, the Directors and officials of the Liverpool Gas Company are just as honourable men as (say) Mr. Carr and the members of the Liverpool Corporation; and, as was said in the Parliamentary Committee rooms last session, any savings that accrued in the case of Liverpool from the proposed change of burner would automatically revert to the consumers. A Committee of the House of Lords, and a Committee of the House of Commons, were of the same opinion; and they saw no reason to accept, and did not do so, any narrow-minded view that Liverpool gas affairs were directed by men whom it was necessary to bind hand and foot in this matter. However, the great point of interest is that the Liverpool Corporation are adopting the "Metropolitan" No. 2 burner for Fazakerley gas, and that we now learn from Mr. Carr's letter that they were never opposed to it *per se*. We remember, however, that Mr. Talbot, K.C., the Counsel for the Liverpool Corporation, remarked in his speech before the Commons Committee: "I ask you not to change Liverpool at all;" but "a reduction of price would be better than nothing." We take it, too, from what Mr. Carr says that he is responsible for advising the Liverpool Corporation to now adopt the "Metropolitan" No. 2 burner. If that is so, it is a singular thing; and, seeing that he considers the burner is capable of most improper use, it is a matter that requires explanation. Let us quote one or two pertinent points from his evidence last July in the Commons:

> I held a high opinion of that burner until I heard Mr. Carpenter say before the other inquiry that he could obtain a good result or a result from a non-luminous gas. He told the Committee in the other house that by testing methane, which is practically a non-

luminous gas, in this particular burner he could obtain a light. Up to that moment I had thought this was a good burner, but that set me to work to consider how that came about; and since then my views with regard to this burner have undergone considerable change as a result of what Mr. Carpenter said.

And again:

What Mr. Carpenter said about the effect of getting the light from the non-luminous gas has led me to change my views; and I say that in consequence of my recent investigations, I no longer regard it in the same light. It is capable, of course, of fair and proper treatment, I do not deny that.

The Chairman: Do you mean that it could be improperly used?

Mr. Carr: Yes, it could be improperly used; it is capable of most improper use.

At the will of the tester?—At the will of the gas maker; that is to say, it very frequently happens in the process of gas making that an excess of air may get into the gas, which would immediately be detected in the old burner, but it would not be detected in *this*, because the operator in making the test would admit less air to the burner in consequence of the air contained in the gas.

In other words you think the gas companies might fraudulently defeat the test?—I do. I say this opens up a possibility I never dreamed of until this matter came forward.

This is the burner that is going to be adopted for testing Fazakerley gas—presumably on the advice of Mr. Carr. There are various constructions that can be put upon the fact that certain evidence given by our correspondent before the Commons Committee was (to use his own words) "left severely alone by Counsel for the Bill." Counsel no doubt would have dealt with the evidence had he thought it would have had any influence on the Committee. Manifestly, the result of the Committee's deliberations showed that Counsel did not harm his case by the course he took. The oft-repeated quotation from a speech delivered by Mr. Charles Carpenter two years ago comes into play again. The official testings of gas last year (*ante*, p. 291) show that the South Metropolitan Company are getting below the illuminating power figure then quoted, without making any appreciable difference in the calorific value of the gas. But enough is said on our correspondent's letter. Such experience as there has been in the gas industry is not to be discarded in favour of the personal opinions of the few.—Ed. J.G.L.]

LEGAL INTELLIGENCE.

SOUTH LINCOLNSHIRE WATER COMPANY'S POSITION.

Appointment of a Receiver.

In the Chancery Division of the High Court of Justice last Friday, Mr. Justice Parker had before him a motion on behalf of a debenture-holder (Mr. Harbottle) for the appointment of a Receiver in the case of the South Lincolnshire Water-Works Company, Limited.

Mr. Northcote, in support of the motion, said the Company was incorporated under a Special Act of Parliament in 1906, with a capital of £30,000 and borrowing powers limited to one-third. The capital had since been increased to £42,000, and £10,000 of 4½ per cent. debentures had been issued. The debenture deed took the form of an assignment to the debenture-holders of the undertaking of the Company, including all future calls on the shares and the rates and tolls authorized by the Act. The interest was payable half yearly—on June 30 and Dec. 31. The interest due at the close of last year had not been paid; and thereupon the plaintiff commenced the present action. It appeared that in 1909 the Company made arrangements with certain contractors to construct works and lay mains. They had failed to carry out the contract; and the consequence was that the mains had not been laid throughout the entire district. About 15 miles had been put down, but with gaps between them—in one case of five, and in another of one-and-a-half miles. It was recognized that, as matters stood, the Company could not complete the works; and these were now practically derelict. He therefore asked for the appointment of a Receiver to protect the security.

Mr. Justice Parker remarked that this being a Statutory Company, he could only appoint a Receiver of the tolls; and there appeared to be not any to receive.

Mr. Northcote said he had a charge on the uncalled capital; but he did not know whether there was any.

Mr. Gurdon, for the Company, said that as soon as the circumstances were discovered all the Directors retired, and a fresh Board was elected, who at once issued a notice to the shareholders explaining the position, and inviting them to subscribe further capital in order to save the concern. The response was not so large as the Directors had hoped; and they did not consider that they would be justified in going to allotment on the applications which came in. He did not feel that he could ask for the motion to stand over for a fresh scheme for raising money to be formulated; but he might draw attention to section 12 of the Act of 1906, under which he understood the motion was brought. This provided that, in order to authorize the appointment of a Receiver, there must be not less than £1000 in arrear. Here the principal was not repayable.

Mr. Justice Parker said he thought the section mentioned applied to the appointment of a Receiver under the powers contained in the debenture deed, not to an application to the Court.

Mr. Gurdon agreed, but said he thought he ought to call attention to it. In any event, the capital under the debentures was not repayable, he understood, for twenty years. The Directors had done all they could, and had not been able to raise the necessary money; and they could only leave the matter in the hands of the Court. The notice of motion asked for the appointment of a Manager, as well as a Receiver; but his friend did not ask that now.

Mr. Northcote said he did not press this part of the motion.

Mr. Justice Parker said he did not see what a Manager could do, unless there was some superfluous land. He could only appoint a Receiver of the tolls; and he would appoint the gentleman named—Mr. William Cash, of 90, Cannon Street—on his giving security.

ALLEGED FALSIFICATION OF A BOOK.

Charge against a Maidstone Gas Company's Official.

At the Maidstone Police Court last Tuesday, Henry Hickmott, aged 50, for many years a collector in the employ of the Maidstone Gas Company, was brought before the Magistrates on a warrant, charged with falsifying one of the Company's books—namely, the Gas-Rental Summary Book.

Mr. Robert Hoar, who appeared to prosecute, at the opening of the proceedings expressed the very deep regret with which the Directors had felt themselves bound to institute these proceedings against a man who had been in their employ for between 30 and 35 years; but they felt it was a duty they owed to the shareholders and the public. He might state that it had never been his misfortune to have so painful a duty cast upon him as to prefer a charge of this kind against an official of a public company; and the fact that the defendant was an old and trusted servant of the Company—a man whom he had known all these years—made it all the more difficult for him to prosecute. It was his intention that day to lay before the Court sufficient evidence to justify a remand, in order that a more careful examination than had yet been possible might be made of the Company's books. It was only a few days ago that an examination of the accounts was being made by the Company's professional Accountant, Mr. A. W. Drew, which disclosed the fact that certain entries had been made in this book, which was kept by Mr. Hickmott with the assistance of a clerk, Mr. Meades. The book was called the "Rental Summary Book;" and these entries led the Accountant to the conclusion that they were made with the purpose of defrauding the Company. It was easy to distinguish the handwriting of the different entries. In the book, there were 21 separate entries on each page. The entries, so far as they were important, were the number of cubic feet consumed and the price charged. There were three other columns—rent of meters, rent of cooking-stoves, and rent of heating-stoves and fittings. So that there were in figures—pounds, shillings, and pence—four columns. The price had to be carried out in the next column to the quantity consumed—2s. 6d. per 1000 cubic feet. This was the calculation made in each case. As each item was carried out and the price at the same figure, it was clear that the totals when casting up should work out at the same—2s. 6d. per 1000 cubic feet. He admitted that in casting these columns—there were six in all—anyone might easily make a mistake. When the columns were totalled up, it was seen that there was a mistake of a serious kind. The total gas consumed was wrong by a million cubic feet, and the price was wrong by the equivalent sum of £125; and the cross cast total was wrong by the same sum. Mr. Meades, the clerk in the office, would tell them that certain of these figures were his, and that certain other figures, which he must call the incriminating figures, in order to distinguish them, were——

Mr. H. J. Bracher (for the defence): What is the date of this?

Mr. Hoar: It is for the quarter ending June 30, 1910.

The Mayor: Is it usual to leave all your work in pencil?

Mr. Hoar: No, it is not. You will see from this book that it is only that quarter which is left in pencil. Continuing, he said he would admit at once that this page had been initialled at the end by one of the Auditors of the Company, Mr. Frank Wright, who was now in China, and who could not therefore explain whether he cast up these figures, or whether he took it for granted that they were correct. It was Mr. Wright's duty to look through certain accounts, and he had initialled these accounts. He did not know in what condition the book was when Mr. Wright saw it—whether the pencil work was there or not; and it might be necessary to adjourn for his attendance, though he could not be there for two or three months.

The Mayor: There is no ink there?

Mr. Hoar: No; but we are able to say whose writing it is. Continuing, he said that the result of this shortage of £125 was that the sum was carried in the cash-book to another account, and credit was given to the slot-meter rental account for this £125, instead of to the ordinary consumers. Mr. Drew, on finding this in the book, told Mr. Hickmott he must report it to the Directors. They met on the previous Thursday morning; and he so reported it. The Directors then decided that they must adjourn their meeting, as it was an important matter, to the afternoon, and go into it more carefully; and Mr. Hickmott was asked to attend the meeting. The Directors met; but, to their surprise, Mr. Hickmott absented himself. The result was that, on the Directors going into the books, another case was found in the following quarter on the same lines, but to the amount of £75, instead of £125. The Directors instructed that a warrant should be issued; but nothing could be heard of Mr. Hickmott's whereabouts. When the warrant was issued, however, it was only right he should say, Mr. Hickmott gave no further trouble to the authorities. He surrendered at once; and was there to give such explanation as he could.

Evidence having been given of his arrest in London, on information supplied by the defendant for the purpose of surrendering, the hearing was adjourned until to-day; defendant being released on bail.

Theft of Gas.

The Aldershot Magistrates had before them last week Arthur Alderton and May Clarke, who were charged with stealing a quantity of gas, the property of the Aldershot Gas Company, at Farnborough. An official, on visiting the premises occupied by the defendants, found that the meter had been removed, and the inlet and outlet pipes connected, by means of a piece of compo. pipe, in such a way that a supply

of gas was secured without registration. Gas was burning at the time of the visit. The man, on being questioned, stated that he was merely a lodger; but ultimately he admitted full responsibility for what had been done. He was a gas-fitter employed at the Aldershot Camp. Both prisoners pleaded guilty. It was said that Alderton had been working for the Government for fourteen years, at the good rate of wages of 8d. per hour. Mr. R. W. Edwards, the General Manager of the Company, remarked that he would like to emphasize the seriousness of the case in the interest of the public. This had been carried out by a man taking advantage of his skill, which enabled him to secure gas without it being registered in the ordinary way. These cases had been going on for a number of years; and the amount of gas lost could not be over-estimated, for he was sure that people taking it in this way were not very economical in its use. Alderton was sentenced to two months' hard labour; while Clarke, on the assumption that she acted under the influence of the man, was fined £1 1s., with the alternative of a month's imprisonment.

Beaufort Gas Company in Liquidation.

In the Chancery Division of the High Court of Justice on Monday last week, before Mr. Justice Parker, a motion for judgment in a debenture-holder's action came on as a short cause; the Company not having delivered any defence. It appeared from the statement of Mr. Herbert Mackay, who appeared for the plaintiff (one Maddocks) that in October, 1909, the Company issued 30 debentures, of which 27 were held by a Mr. Davis, who transferred 10 of them to plaintiff, who was the registered holder. One of the conditions endorsed on the debentures was that if an execution were put in on any part of the property charged, the principal money should immediately become payable; and this happened on Jan. 13, 1910. Soon after that date, the Company was ordered to be wound up in the Monmouthshire County Court. Mr. Frederick Gardiner, of Newport, was appointed provisional Liquidator; and an order was made allowing the plaintiff to proceed with the present action. Mr. Davis, who had previously been appointed Receiver on behalf of the debenture-holders, having resigned, an order was made during the Long Vacation appointing Mr. Frederick Rowland as Receiver. He had since been appointed Liquidator of the Company, and was now represented by Mr. Percy Wheeler. The minutes of the proposed order contained the usual inquiries, and an order for sale by the Receiver—the proceeds to be brought into Court to the credit of the action. A summons asking for a sale had already been taken out, on which an affidavit had been filed, to the effect that a sale would in any event be necessary. Mr. Wheeler said his clients had only recently been instructed; but they had reason to doubt whether some of the debentures had been validly issued. He therefore asked that these words should be added—"Without prejudice to any question to be raised, on the taking of the accounts, as to the validity of all or any of the debentures." His Lordship assented to this; adding that if all the debentures were void, a sale might not be necessary.

Discs in a Prepayment Meter.

At the Littlehampton Petty Sessions, on Monday of last week, George W. Spencer, a printer, was summoned for fraudulently abstracting 6500 cubic feet of gas, value 28s. 9d., the property of the Littlehampton Gas Company—a charge to which he pleaded not guilty. It was stated that the case was brought under section 38 of the Gas-Works Clauses Act, 1871. The house occupied by the defendant had a shilling-in-the-slot gas-meter; but when the collecter went on Jan. 12 to collect the money in the ordinary course, instead of finding shillings, he found the drawer of the meter contained only sixteen metal discs. The meter recorded a consumption of gas to the extent of about 29s. The proceedings were taken at the request of the Directors, who, knowing that this practice had occurred once before, thought the only course open to them was to bring the matter before the Bench. Mrs. Spencer told the collector she put the discs in because she had no money at the time; and after he had opened the meter, he did not ask her for any money. It was not a fact that she offered him 10s.; and he did not remember her saying she would give him the balance when her husband came home. If discs were found in the meter on a first occasion, and the full amount was then offered for the gas, it was accepted, and a caution given. He had not collected discs from defendant's meter before. A fitter said he heard Mrs. Spencer say she could give 9s. or 10s., but had no more. The money was not accepted. In October, when he was with another collector, several discs were found, and Mrs. Spencer came to them when they got outside and tendered the money. The collector told Mrs. Spencer not to use them. The cash in the meter was short, and defendant had to pay 9s. or 10s. There were then six or seven discs in the meter, and they were paid for. Mr. A. W. Elton, the Manager of the Company, stated that he received a report from the collector, and ordered the service to be discontinued, because he had had trouble with the defendant before. On July 12, he received a letter from the defendant in which he said: "Of course, I admit putting in some discs when I did not have any change in shillings, but your collector told us on a previous occasion that this course was accepted, provided the shillings were paid for the discs when the meter was cleared. I am prepared to give an undertaking that no more discs shall be used from this date." The discs would give precisely the same amount of gas as a shilling; but if the disc got bent on being put into the meter, it might keep the passage open, and thus give a perpetual supply. The seal of the meter had been tampered with. He did not know that in October six or seven discs were found in the meter. If the collector received money for them, it was without his consent. Defendant, in a statement to the Bench, said money for the discs would have been handed to the collector had he (defendant) been at home when the official came. He was prepared to admit having had 29s. worth of gas. The Chairman said it seemed silly for anyone to use these discs; and the Gas Company would have to make stringent rules about it. The Magistrates did not think there was sufficient evidence to convict; and the case would be dismissed.

MISCELLANEOUS NEWS.

BERLIN CORPORATION GAS UNDERTAKING.

Report for the Year 1909-1910.

Some further particulars from this report, the publication of which is continued in the current number of the "Journal für Gasbeleuchtung," may be quoted to supplement the principal figures given in the "Journal" last week (p. 320).

A nine-hours day was introduced at the beginning of the year throughout the works, except in the case of men who were already employed in shifts changing every eight hours. The five gas-works belonging to the Corporation all continued in work, though the production of the No. III. Works was reduced to 8·6 per cent. of the total in view of its being ultimately shut down. On the other hand, the No. VI., or Tegel, Works, increased its output from 24·4 per cent. to 26·9 per cent. of the total production of gas. Water-gas plant was in continuous use at four of the works; and the proportion of water gas in the gas distributed increased to 11·8 per cent., as against 10 per cent. in the previous year. In order that the calorific power of the mixed gas should not be reduced in consequence of the greater proportion of water gas, the amount of oil used for carburetting was increased from 10·42 to 12·89 lbs. per 1000 cubic feet of water gas made. The coke consumed in the generators amounted to 46·55 lbs. per 1000 cubic feet of water gas made, which is less than was consumed in the previous year. The fuel consumed in the production of steam for the water-gas plant was mostly coke breeze, and amounted to 30·01 lbs. per 1000 cubic feet.

In the manufacture of coal gas, the coal used consisted of 62 per cent. of English, and 38 per cent. of German origin. The use of English coal has increased from year to year since 1900, because German coals have become dearer. In the year 1900, only 8·5 per cent. of English coal was carbonized. The report states that unless the German coal-owners soon lower their prices for gas coal, nearly the whole of the Berlin gas-coal market will be lost to them within a short time. The make of gas per ton of coal carbonized amounted to 11,611 cubic feet, which is a trifle higher than in the previous year. The fuel used in heating the settings amounted to 17·9 per cent. of the weight of coal carbonized, or to 34·51 lbs. per 1000 cubic feet of gas made, as compared with 35·38 lbs. in the previous year. The carbonization was distributed between different types of retorts as follows: Horizontal, 445,084 retort-days; inclined, 365,007 retort-days; and vertical, 44,178 retort-days. Self-recording calorimeters were used to control the calorific power of the gas, and a gross calorific power of not less than an average of 545 B.Th.U. per cubic foot was observed. Continuous recorders of the proportion of carbonic acid in the water gas were also used.

The reduction in the increase in the output of gas, as compared with the annual increases for several years past, is stated not to be peculiar to Berlin, but to have been observed in many other towns in Germany of large and moderate size. The increase in gas consumption has been greater in the hours of daylight than in the night-time, which indicates that the greater part of the increased gas consumption is for cooking and heating purposes. The gas consumed in the daytime (*i.e.*, at the hours when the street-lamps are not alight) amounts to 39·6 per cent. of the total output.

In regard to bye-products, the coke in store was considerably greater in quantity on April 1, 1910, than on the same date in the previous year, in consequence of the mildness of the winter of 1909-10. The amount of tar produced was equivalent to 4·7 per cent. of the weight of coal carbonized; while the tar produced in the carburetted water-gas plants was equivalent to 19·5 per cent. of the weight of oil used. A larger proportion than formerly of the production of liquor was worked up in the Corporation's own factory to sulphate and concentrated gas liquor.

The distributing system was extended in the course of the year by a length of 57·6 miles of mains. This makes the total length of main at the end of the year 950·4 miles, of which 145·8 miles are pipes of from 12½ to 47½ inches in diameter.

TOTTENHAM AND EDMONTON GAS COMPANY.

The Half-Yearly General Meeting of the Company was held last Saturday, at the Offices, High Street, Tottenham—Mr. Corbet Woodall in the chair.

The Secretary (Mr. E. Topley) read the notice convening the meeting; and the Directors' report and the accounts were taken as read.

Special Features of the Accounts.

The Chairman said, before referring to the accounts, he should like to say how glad he was—and he was sure his colleagues also—to see so large a meeting, and to know it was partly composed of those who were now co-partners, and at the same time workers, in the establishment. In moving the adoption of the report and accounts, he said they might be taken as being, on the whole, satisfactory. It would be remembered that, at the commencement of the year, there was a reduction in the price of gas of 1d. per 1000 cubic feet; and this meant a reduction of the amount of profit that would otherwise have been earned by rather more than £3000 for the half year. This notwithstanding, they were able to pay the increased dividend, add to the amount of the bonus of the employee co-partners, and carry forward a larger sum than was brought into the account. What he had said was not a complete statement of the facts. They had applied £1796 for the purpose of writing-down the value of the investments which had depreciated in the market. They had also carried £1000 to the insurance fund, and £3000 to a special renewals fund, to provide for

special works of reconstruction and renewal which were outside the ordinary wear and tear and maintenance of the establishment.

THE VALUE OF A RENEWALS FUND.

As an illustration of the value of the renewals fund, he might mention the case (which he thought he touched upon at the last meeting) of one of the gasholders at the works, which was no longer suitable for the requirements of the Company, and which had therefore been abolished. This holder was built in 1866; and it stood in the capital account at £5500. Thanks to the operation of the renewals fund, they had this year wiped out of the capital account the whole of the £5500. He did not think it necessary to labour the desirability of watching carefully that works of this sort, abandoned from various causes, did not remain as a charge upon the capital account. If they did, then, as a matter of course, the amount of the nominal capital remained higher than the assets justified, and consequently the charge for interest and dividend upon this capital was inequitably large. The tank of the abandoned holder had been roofed over, and would form a valuable addition to the storage for ammoniacal liquor. The sum spent upon extensions of buildings and plant in the half year was £10,167. Against this there was a credit of £4500 taken from the renewals fund; and the net increase was therefore only £5667.

POINTS FROM THE MANUFACTURING STATEMENTS—DRY COKE.

During the half year, more coal had been handled than ever before; and the sale of gas had been greater by 4½ per cent. The quantity of coal used was less in proportion than the quantity of gas made, because the amount of gas made per ton had reached the highest they had ever achieved at Tottenham hitherto—being 12,386 cubic feet. The quantity of carburetted water gas bore the same proportion to coal gas as in the previous year; but the illuminating value of the mixed gas as issued to the consumers had been increased by ⅓ candle, and the calorific value was also higher than before. All residuals had yielded higher prices; and with the exception of coke, the quantities per ton of coal had been better. Coke was a disappointment; and the Engineer was still in search of a satisfactory explanation of why the return was not better. One thing, he (the Chairman) thought he might say, was certain. It was that, to some extent, the buyer was profiting by the Company's loss, because he believed the methods of handling coke to-day resulted in its being sent out practically free from moisture. The sale of coke in paper bags continued to be an important feature in the trade of the Company.

GOOD PROSPECTS—FURTHER REDUCTION FORESHADOWED.

The values of all residual products were good; and there was every prospect that good prices would be maintained. He might mention that the Directors had anticipated their coal and oil requirements for the greater portion of the year ending June, 1912, at prices which were considerably below those ruling in the existing contracts. Putting these two facts together, he thought it would be evident they had not yet reached the ultimate price for gas to which he was looking forward. If they were not much disappointed, a further reduction would take place in a comparatively short period. This, he was quite sure, would be acceptable not only to the older proprietors, but to those who were attending the meeting for the first time. It might interest the proprietors to know the proportion which the various co-partners in the undertaking took of advantage from a reduction of 1d. per 1000 cubic feet. The consumer received £7300; the proprietors generally got £730; and the employee co-partners £360. The proportion was rather interesting. The consumer obtained nearly ten times the amount the ordinary proprietor received; and the employee co-partner came in for half the amount that went to the whole body of proprietors.

A DECADE'S NOTABLE PROGRESS.

Some figures had been prepared for him by the Secretary, showing the growth of the Company during the first decade of the century. Some of them he was afraid he had alluded to before. To him, however, they were always interesting; and he hoped they would not bore the proprietors. In 1900, the capital expenditure was £323,000, which was equal to £518 per million cubic feet of gas sold. In 1910, the capital was £660,000; and the amount per million was £424. Had the proportion remained as it was ten years ago, the capital, instead of being £660,000, would now be £806,000. The dividends in 1900 were 6 per cent. and 4½ per cent.; and now they were 7 per cent. and 5½ per cent. The cost of dividend and interest together were respectively 7·59d. and 6·03d. per 1000 cubic feet, so that upon the item of dividend and interest they had saved in ten years 1½d. per 1000 cubic feet on the gas sold. The reserves ten years ago amounted to £18,000; to-day they were £62,800. The number of consumers had grown from 16,675 to 56,724, or 240 per cent.; while the gas sold was 1557 million cubic feet, against 633 millions—an increase of 150 per cent. The increase in the number of consumers was greater than the quantity of gas sent out; showing that the addition had been very largely from the smaller consumers, who, as he had remarked before, represented a broader basis for the business of the Company. The price of gas ten years ago was 3s. 4d. per 1000 cubic feet; now it was 2s. 3d. Another interesting item was this: In 1900, they had issued stoves of various kinds in the proportion of 1 to 5·3 consumers; now the proportion was 1 to 2·3 consumers. A result of this large increase in the proportional use of stoves was that the consumption per prepayment consumer had risen by over 15½ per cent., which, to his mind, was most satisfactory.

CHANGES IN THE DIRECTORATE.

At the last meeting, he reported that Mr. Gerald Watson, one of the Directors, was ill, and that, although he had attended the Board meeting that day, he did not feel equal to facing the fatigue of the general meeting. Very shortly after that, he wrote to him (the Chairman) placing his resignation in the hands of his colleagues. He begged Mr. Watson to take time before arriving at a definite conclusion, to see whether his health would not improve. Mr. Watson took his advice; but a few weeks later, he sent him (the Chairman) a letter saying that his doctor urged him to break with his business engagements. The Directors then, with very much regret, accepted the resignation. Mr. Watson had been with them as a valued colleague for twelve years; and he had never spared himself in the service of the Company. The Directors had selected to fill his place Mr. Henry Woodall, M.Inst.C.E., who was with them in that capacity at a proprietors' meeting for the first time that day. Their new Director had had a large experience in the construction and control of gas undertakings; and he (the Chairman) was sure he would be an able and helpful recruit to the Board and to the service of the Company.

Mr. Henry Bailey seconded the motion.

Mr. G. H. Michell remarked that he thought he might say, on behalf of the proprietors generally, that they were perfectly satisfied with the conduct of the affairs of the Company. The Legislature had wisely provided for meetings of this kind between Directors and proprietors, in order—this was the legislative theory—that they might hold a sort of conference on questions of mutual interest; and he thought it was the duty of the proprietors to come to the meeting, to at least show the Directors and staff that they were grateful for their conduct of their affairs, and that they were following, with interested observation, everything that was being done. There was one question he should like to ask. During recent years, the history of the Company had been one of uninterrupted progress; but there was a fatal disposition on the part of the human being to say that as it was to-day, so it would be to-morrow, but very often those optimistic predictions were falsified in actual experience. Therefore, those proprietors who had looked over the accounts were glad to see the Board realized this by building up large reserve funds. He should like to ask whether the reserve fund would be available to meet the exigencies of a great crisis—such as an abnormal rise in the price of coal. Would the reserve then be available for dividend purposes? though he did not suggest it would be wise to deplete the reserve for such a purpose. The Company were indeed in a happy position, because they were selling gas at almost the lowest price it had ever touched near London. It was now 2s. 3d. per 1000 cubic feet; whereas only some four miles from there it was 3s. 6d. In this way, not only were the Company meeting the requirements of the populous district by supplying good gas at a low price, but they were providing the proprietors with a secure investment.

The Chairman thanked the honourable proprietor for his friendly observations. He had referred to the optimism of some boards of directors. He (the Chairman) was afraid he had occasionally fallen into prophecy when addressing the meetings of the proprietors; but he could say, at any rate, that the prophecy had never been falsified by the event. In regard to the use to which the large reserve fund could be put, it was for the purpose of equalizing the dividend. If the price of coal went up to such an extent as to imperil the dividend, they could draw from the reserve to make up the amount required. But they had also an undivided balance, which was at an amount just about equal to the reserve fund. This was absolutely fluid, and could be used for the same purpose. The honourable proprietor also referred to them as being possibly the lowest priced Company in the neighbourhood of London. They had not reached such a happy position; but they were striving very hard to attain it. In a short time, unless some special catastrophe happened, they would make further strides in this direction.

The motion was unanimously carried.

THE GAS INDUSTRY NEVER STRONGER.

Sir Daniel F. Goddard, M.P., the Deputy-Chairman, moved the declaration of dividends at the rates of 7 per cent. per annum on the "A" consolidated stock and of 5½ per cent. on the "B" consolidated stock, both less income-tax. Having pointed out that these were the maximum dividends allowable by Act of Parliament at the present price of gas, he said that he supposed nowadays, with the constant growth of the use of electricity, ordinary shareholders in gas companies did sometimes feel a little natural anxiety as to whether the prosperity of their particular investment would continue. He did not think there could be any real alarm about this, if they would consider the natural history of gas undertakings. The gas industry had now been for some years confronted with this competition, and had been able to hold its own notwithstanding. It was now nearly forty years since Jablochkoff brought into notice the wonderful and beautiful electric candle, which was, so it was thought at the time, to sound the death-knell of all gas undertakings. It was about thirty years since that Edison in America and Swann in this country introduced the electric incandescent burner, which caused such a flutter among gas shareholders that a great many sold their shares, which proceeding they afterwards bitterly regretted. Notwithstanding prophecies made so many years ago, and the growth of the electrical industry, what was the position of gas undertakings at present? He thought that anybody who studied the history and development of gas undertakings (not merely this one, though he was bound to say it was a good example, but every one) would say that the gas industry was stronger, was more wealthy, was more useful, and was more needed than it ever was before. This was a striking record to keep in their minds. He therefore hoped no one would be uneasy as to the trustworthiness of his investment in the undertaking.

THE DAY AND INDUSTRIAL USES OF GAS.

The growth of the industry, and the maintenance of its position in the industrial world, was due largely to the fact that thirty years ago gas was used mainly, or almost entirely, for lighting, whereas to-day it was used, not only for lighting, but for heating, cooking, and power; and there were still further fields for its use. They were coming (he might almost use the expression) daily into prominence, by means of supplying gas at high pressures, which not only gave the gas a great advantage from the lighting point of view, but enabled it to be used in industrial work in a way in which it was never utilized before. It was seen by the industrial records of the day that gas under pressure was being used in many industrial occupations. Some of the great London daily papers were using gas under pressure for the melting of their "stereos," and it was now being employed in industry in many directions. In this new development, they saw a great chance of growth. While it was interesting to find there was this growth of business, it had another profitable effect, inasmuch as these uses of gas tended to equalize the demand during the twenty-four hours; the various applications to heating bringing gas

into use in the daytime. In another gas company with which he was connected, the quantity of gas consumed during the day hours some thirty years ago only reached 21 per cent. of that sent out; in the month of June in the same company, the quantity of gas now sent out in the daytime was 55 per cent. of the whole load. He believed it would be found that, as gas became cheaper, so would its uses become more general; and so would the position of this industry of theirs become stronger, and more secure. Therefore, the proprietors would not only appreciate the reduction of the price of gas foreshadowed that day because it would add a little to the dividend, but they would appreciate it all the more because it would add to the permanent security of the undertaking in which they were all interested.

Mr. James Cloudsley, J.P., seconded the motion, which was unanimously agreed to.

Moved by Mr. A. C. Marsh, and seconded by Mr. George Bell, a hearty vote of thanks was passed to the Chairman and Directors and the Auditors.

Lighting Consumers and their Consumption.

The Chairman, in the course of his remarks in acknowledgment, said a great deal had been said about the reduction of the consumption of gas for lighting purposes by reason of the introduction of gas-saving incandescent burners. Their Secretary had made a laborious investigation of some 9000 accounts; and he had found 1000 in which the residents had not changed in the last ten years. In a certain number of these cases, gas was still used for lighting only. In these cases, while ten years ago the consumption per consumer was 32,000 cubic feet, it had risen to 37,000 cubic feet in the past year; so that, notwithstanding all the advantages of the new burners, the demand for light had increased. In these houses the rate of consumption had gone up by 16 per cent. Where there had been added to the lighting the use of gas for cooking and heating, the consumption had gone up from 33,000 to 52,000 cubic feet, or 56 per cent. Proceeding to move a vote of thanks to the officers, their staffs, and the workers, the Chairman said he thought he could say now that the Board were satisfied with the result of the introduction of co-partnership. There was evidence that employees were seeking to the best of their ability to effect economies, avoid waste, and improve the prosperity of the undertaking.

Mr. William Robertson seconded the motion, which was heartily carried.

Mr. A. E. Broadberry (the Engineer and Manager) and Mr. E. Topley (the Secretary) responded, and the proceedings terminated.

CARDIFF GAS COMPANY.

Colonel William Taylor, M.D. (the Chairman), presiding at the annual meeting of the Cardiff Gas Company, said he was glad to be in a position to be able to congratulate the shareholders on the increased prosperity of the Company. The Board had decided to take advantage of the powers vested in them to issue additional debenture stock and some consolidated ordinary stock. There was an increase of 27 million cubic feet in the output of gas; while the receipts from sales of coke, tar, and other residuals were well maintained—being £2158 more than the previous year. The Directors took advantage as far as possible of all the latest improvements in machinery and plant, so as to secure the best results for the shareholders and the consumers. Since last year, the Company had sunk an artesian well at Grangetown, which now supplied them with water at the rate of 11,000 gallons per hour—principally used for quenching coke. This meant a saving to them of about £200 per annum, and would increase as their water requirements developed. They were looking forward to fresh sources of revenue; and he was pleased to tell them that the new plant for the manufacture of sulphate of ammonia was rapidly nearing completion, which would save them the middleman's profit. To complete the process, works for the production of sulphuric acid would also be erected. The establishing of central show-rooms and a branch office in Queen Street had proved a distinct success, and was a great convenience to consumers generally. The slot-meter department had developed in a remarkable manner; there being now 13,000 consumers by this means. The weight of the coppers collected last year was nearly 80 tons. Every department of the Company was in a highly flourishing condition. The co-partnership scheme was working very well indeed; and he was pleased to see representatives of the men present at the meeting for the first time in the history of the Company.

The report was adopted, dividends at the usual rates were declared, and votes of thanks were passed to the Chairman and Directors, to the Manager and Secretary (Mr. George Clarry), and to the Engineer (Mr. H. D. Madden).

YORK UNITED GAS COMPANY.

The Half-Yearly General Meeting of this Company was held last Wednesday—Mr. J. Melrose, J.P. (the Vice-Chairman), presiding, in the absence, through indisposition, of Mr. J. R. Hill, the Chairman.

The Secretary and Manager (Mr. J. H. Hill) having read the notice convening the meeting, the report of the Directors was presented. It showed a sum of £8066 available for distribution, and the Directors recommended the payment of a dividend at the rate of 4 per cent. per annum (less income-tax) on the preference and ordinary stock, after which there would be a balance of £156 to carry forward.

The Chairman, in moving the adoption of the report, said it would be agreeable to the stockholders to receive their usual maximum dividend, and to know that the Company had met all their obligations, maintained their plant in proper working condition, and had a balance to carry forward. Comparing the half year with the corresponding period of 1909, they had increased the sale of gas by 3 million cubic feet, and the revenue from this source was higher by £374. Residual products showed an increase of £722; but fitting and miscellaneous items were lower by £192—leaving a net increase in their revenue of £1149. The Directors submitted the report with satisfaction as showing that, notwithstanding the competition they had to meet, the Company continued to make steady progress. From the general point of view of the gas industry, the Board of Trade returns for 1909 were very encouraging. They showed an increase of 3628 million cubic feet of gas made, 247,946 consumers, 12,207 public lamps, and 740 miles of mains; also that modern carbonization practices had effected a considerable advance in the gas made from a given quantity of coal. He thought the proprietors would concur with him that these evidences of an expanding industry developing economy in its methods of working were eminently satisfactory. There was another matter he wished to mention which was of a gratifying nature. It was an extract from the "Journal of Gas Lighting" for Oct. 18, 1910, which showed that medical men, for various reasons, were now returning to gas after having used electricity. [The Chairman read the editorial article on the change from electricity to gas at the rooms of the Society of Medical Officers of Health; also the following extract from a speech by the Chairman of the Committee of the Society: "No member who had experience of their meeting-room under the old conditions could deny the improvement that had taken place since gas had been substituted for the electric light and the new system of heating and ventilation had been installed."] He thought he had said enough to satisfy any reasonable person that the gas industry generally, and their own undertaking in particular, were thoroughly sound and satisfactory.

Mr. W. W. Hargrove seconded the motion; and it was carried unanimously.

The dividend recommended was then declared; and the proceedings closed with a vote of thanks to the Directors.

IMPROVED GAS BUSINESS AT CAMBRIDGE.

Output Doubled since 1890.

A very satisfactory statement was made by the Chairman of the Cambridge Gas Company (Mr. E. H. Parker, J.P.) at the half-yearly meeting last Tuesday, when the accounts for the six months ended Dec. 31 showed a profit of £6264 on the revenue account, compared with £5571 in the corresponding period of 1909, and a sum of £22,384 available for distribution. The Directors recommended the payment of the maximum dividends, less income-tax. The quantity of gas sold was 182,139,400 cubic feet, compared with 173,993,000 cubic feet in the second half of 1909. In moving the adoption of the report, the Chairman pointed out that the capital account required replenishing; but he assured the shareholders that the Directors were using their best endeavours to be careful in the expenditure of money. In the year ended Dec. 31, 1899, the capital charges per 1000 cubic feet of gas sold amounted to 10·03d. They had, however, gradually come down; and in 1910 they were only 7·81d., which was satisfactory in all respects. There was an item in the revenue account which would give the shareholders great pleasure—viz., "To co-partnership account, £375." The employees were now deriving benefit from the prosperity of the Company, which the Board thought was fair, right, and equitable; and they were sure the shareholders would agree in this. The Chairman passed on to quote figures to prove that the Company's business was not stagnating. He said that 574 tons more coal had been carbonized, and the increase in the make of gas was no less than 8,720,900 cubic feet. The make per ton of coal was greater by 128 cubic feet—a very good feature for which they had to thank their Engineer and Manager (Mr. J. W. Auchterlonie) and the carbonizing foremen working under him. There was an increase in ordinary consumers of 131, in slot-meter consumers of 193, in ordinary cooking-stoves of 17, in slot-cooking stoves of 128, and in heating-stoves on hire of 65. Another good feature was the large number of heating-stoves that had been sold during the half year—viz., 155; and a branch of the business that was progressing very quickly was the number of lamps fitted outside shops, amounting to 255 in the half year. Another matter of interest was that for the first time in the Company's history the annual make of gas had exceeded 400 million cubic feet. In 1890, it was 206,773,000 cubic feet; in 1900, it reached 286,962,000 cubic feet; last year it stood at 402,591,900 cubic feet. Since 1890, the output had been almost doubled. All these results were very satisfactory; and he thought they were to a large extent due to their able Manager, with whom the Directors found it a pleasure to work. The motion was carried, and the dividends recommended were declared. The Directors were then authorized to increase the capital of the Company by the issue of £10,000 of ordinary stock and the raising of £2500 on mortgage.

Charge for Water for Shipping.—The Liverpool City Council have decided to reduce the charge for water supplies exceeding 500 gallons for shipping purposes from 2s. 6d. to 2s. per 1000 gallons. The proposal was brought forward by Sir Charles Petrie as an amendment to the minutes of the Water Committee. It was pointed out by him that the shipowners had for some considerable time been agitating for a reduction, and that other trading concerns in the city were charged as low as 4d. per 1000 gallons.

Preston Gas Company's Provisional Order.—The Town Clerk of Preston (Mr. A. Howarth) has lately made a statement to the Town Council on the subject of the proposal of the Gas Company to apply for a Provisional Order, and the decision of a Sub-Committee to recommend the Council to oppose. He points out that the terms of the Order—at least the two main features—are the reduction of the illuminating power from 18 to 14 candles, and the alteration of the test-burner from the present "London" argand to the No. 2 "Metropolitan" burner. The Directors of the Company had had an interview with representatives of the Sub-Committee, and offered a reduction in price of 3d. per 1000 cubic feet, on condition that the Corporation would not oppose the Order. The Sub-Committee, however, came to the conclusion that the Corporation would not be discharging their duty to the community if they were parties to any agreement which would have the effect of greatly reducing the standard of illuminating power, particularly in view of the large number of flat-flame burners used; and they therefore recommended the Council to proceed with their opposition. This was unanimously agreed to.

PREPAYMENT METER SUPPLIES AT LEICESTER.

A Reduction in Price.

At a meeting of the Leicester Town Council last Tuesday, the Gas Committee reported that they had had under consideration the practicability of reducing the price of gas to consumers within the borough using slot-meters. The quantity of gas sold under the prepayment system in the year 1909 (the last year for which statistics were complete), was 28 per cent. of the total quantity of gas delivered. The extra cost to the Corporation of supplying gas on the prepayment system was 5·29d. per 1000 cubic feet; and the actual amount paid by the slot-meter consumer in respect of this amount was 5·33d. The Committee, however, recognized that certain items, such as clerical charges, cost of collection, &c.—applicable in the case of the ordinary consumer—were inapplicable to some extent in the case of the prepayment consumer. These factors were difficult to estimate with any accuracy; but they nevertheless existed, and, on the whole, the Committee felt they would be justified in recommending a reduction of 2d. per 1000 cubic feet to the consumers on the prepayment system within the borough.

Alderman SMITH, in moving the adoption of the report, said that in 1894, when the slot-meters were introduced in Leicester, there were 344, consuming 1 million feet of gas. In 1899, there were 12,900 slot consumers, who consumed 216 million cubic feet, or 13 per cent. of the whole. In 1903, there were 26,000 slot consumers, who consumed 339 million feet, or 19 per cent. of the total consumption. In 1909, there were 33,618 slot consumers, consuming 562 million feet of gas, or 28 per cent.; and at the end of 1910, there were 34,783 slot consumers. In 1909, they took in money from the slot-meters £78,000—over 18 million pennies, weighing 176 tons. It was stated that the slot-meter consumer was overcharged. Was that so? He thought not. The slot-meters cost 16s. 3d. extra; the annual upkeep was larger; the cooking-stove was supplied free; and there was the additional cost of inspection. Compared with the charge in other towns, Leicester came out very favourably. The Committee believed they could carry out the recommendation; but that they could not safely go beyond it. A reduction of 2d. would mean £4494. They had at present before the Committee a claim for time-and-a-half on Sundays, which, if granted, would mean an additional £1800 to that department alone. Then they had a request for a week's holiday, which would cost £1230. There was an item for extra cost of coal of £3600; and a proposed reduction in the price of coke would mean £2300 more. This brought the amount involved up to about £13,000, which was as far as they might be legitimately expected to go. He then made an appeal to the Council seriously to consider the position of the works in regard to the reserve and renewal funds. To-day, he said, they had no renewal fund, and only £28,000 was put aside as a reserve. The reserve fund ought to be brought up to £50,000 as quickly as possible. He did not think that Leicester was overcharged for gas; and he asked the Council to hesitate before they committed themselves to any scheme likely to bring about an increase in the rates.

After a lengthy discussion, and the rejection of several amendments, the report was adopted.

WEST BROMWICH GAS UNDERTAKING.

At a meeting of West Bromwich Town Council last Wednesday afternoon, the Gas Committee reported that the quantity of gas sold during the quarter ended Dec. 31 was 107,737,537 cubic feet, and the amount of rental in respect of same was £12,953.

Mr. J. LAWLEY said they used to hear from time to time some very doleful remarks upon the quantity of gas sold and the position of the gas-works. He thought the Chairman of the Committee might now enlighten them as to how the undertaking stood, for he believed they were getting towards the high water mark in the consumption of gas.

The MAYOR (Mr. J. Brockhouse) said there was a short time ago a reduction in the output. He was not prepared to give the actual figures of the undertaking, but he was pleased to say they had now turned the corner, and were going on all right. They would very soon be having the annual report; and he believed the Council would all be satisfied with it.

The report was adopted.

HASTINGS ELECTRIC LIGHT UNDERTAKING.

Local Government Board Inquiry.

At the Town Hall, Hastings, a short time ago, an inquiry was held by Mr. M. K. North, M.Inst.C.E., in regard to an application made by the Corporation for authority to borrow £2083 in connection with their electricity supply undertaking. There was a large gathering of members of the Town Council and others interested, including the Engineer and General Manager (Mr. C. E. Botley) and the Assistant-Engineer and Electrician (Mr. C. F. Botley) of the Gas Company, who opposed the granting of the loan.

It was explained by the Deputy Town Clerk (Mr. T. Wood) that £2000 of the sum for which application was being made was required for laying new mains, and £82 19s. to defray an amount overspent on a previous loan.

In reply to the Inspector, the Electrical Engineer (Mr. R. F. Ferguson) stated that the £2000 would last about two years if the rate at which new subscribers were obtained was continued. He could not yet say where the new mains were to be laid. Answering questions about the excess expenditure of £83, Mr. Ferguson said it had been incurred through meeting unexpected difficulties in laying a high-tension main from the works.

Questioned about a loan of £4000 granted in 1907, the Borough Accountant (Mr. G. R. Butterworth) stated that this had been spent. Having no more to go on with, the Corporation had already spent £20 in anticipation of the present application being granted.

Mr. Patrick Hastings, who (instructed by Messrs. Young, Coles, and Langdon) appeared for the Gas Company, asked the Engineer if it was not a fact that the electric light undertaking of the Corporation had, during the last three years of trading, received £10,000 from the rates; and he replied that it was. He would not, however, admit that it was by no means self-supporting. Mr. Hastings said he would leave the figures to speak for themselves. On being asked some questions as to the past applications, Mr. Ferguson protested. Alderman Tree (the Chairman of the Finance Committee) came to his assistance by inquiring if the questions were relevant; and the Inspector replied that they were quite in order. Asked to state the specific purpose for which the money applied for was required, Mr. Ferguson said it was to make short extensions of the mains into districts where new subscribers had been obtained. This was all the information he could give. He admitted that money had been spent out of the rates to convert gas-lamps to electricity, for which the Local Government Board had not granted a loan. "What is a short extension?" Mr. Hastings next asked. "Well, anything about 200 or 300 yards," explained the Engineer. Maps were produced, and one extension of the main shown there was found to be 576 yards in length. "In that case," acknowledged Mr. Ferguson, "it was not a short extension." Another was 743 yards long, and there were new consumers there. It would cost £148. "Do you consider that a remunerative outlay?" asked Counsel. "No; not just at present," was the reply. There was another extension with respect to which Mr. Ferguson agreed that there was no possibility of houses being built on the main, because a great part of it ran across Alexandra Park. Last year's return showed an increase over the previous year of 66 new consumers, Mr. Ferguson stated in answer to another question. Asked about the price of current, he replied that 2d. per unit was charged to the Public Lighting Committee for the converted gas-lamps, as against 4d. for other lamps, because the former were employed at a time when current was not being used for other purposes. Pressed to say why the arc lamps were charged at 4d., he said it was by order of the Town Council. Mr. Hastings asked if it was not a fact that the converted lamps were charged at 2d. because otherwise the cost would have been more than gas, and the ratepayers would have refused to allow it. "No; I showed the Council that I could do it at that price, and they gave their assent," replied the Engineer.

Evidence was then given by Mr. Hill, the Chairman of the Electricity Committee. In reply to the Inspector, he said the Committee always considered that, apart from promised customers, there was always the likelihood of getting more when once the main was laid. In answer to Mr. Hastings, he said the Committee always considered what were the interest and sinking fund charges on the cost of the new main; and if the expected income covered these, they felt justified in making the extension. "Do the Committee consider at all how many new customers they get as the result of their outlay?" asked Mr. Hastings. "I don't know that they do," was the reply. Asked how the Committee calculated the profit produced by the converted gas-lamps, Mr. Hill explained that the interest and sinking fund charges were just the same in any case; and if the Council spent £100 on converting gas-lamps to electricity, and got £101 in return, this was clear profit. The Inspector said he was afraid he did not understand that. "Nor do I," said Mr. Hastings; "and neither did Mr. Fawcett nor Mr. Hooper (former Inspectors) when they had the same question before them."

The Borough Accountant (Mr. G. R. Butterworth) in reply to Mr. Hastings, stated that the electricity undertaking had been helped out of the rates to the extent of £7000 during the last three years. The total deficit on the working during the same period was £9000. There was a decrease of £1000 in the deficiency each year. Invited to make some remarks on this matter, Mr. Hill pointed out that the Corporation had to pay interest and sinking fund charges on the undertaking to the extent of £10,000 a year, and had to meet this somehow.

Mr. Hastings then addressed the Inspector in opposition to the application. He said the electricity undertaking of the Corporation should be run as a business concern, and the money spent on a commercial basis. But no calculations whatever appeared to be made of the profits that could be derived from any new expenditure. Why did not the Corporation say openly that their undertaking was commercially unsound, and that they were trying to extend the mains out of the populous parts of the town into the country, where there were scarcely any houses? Dwelling upon the case of Clive Vale, where the Corporation had spent £1500, Mr. Hastings said that he and Mr. (now Mr. Justice) Horace Avory had pressed the representatives of the Corporation to show how this could be remunerative. Their case was that a new main once laid attracted fresh consumers. Yet the Clive Vale main had been laid three years and only had four consumers.

"Excuse me," interrupted Mr. Ferguson, "there are now nine in that district, besides the public lamps."

"That becomes humorous—more, it is ridiculous," retorted Counsel, "to say that it is remunerative because after three years you have got nine customers." Continuing, he said he had not heard a word to show that the extensions under consideration were desired by the inhabitants, or were in any way necessary. Former Local Government Board Inspectors had spoken seriously about the folly of charging to the cost of coals the cost of extra light. Yet still the Corporation came on cheerfully year after year with the same old argument, though it had been hopelessly condemned, not only in practice, but by the Inspectors before whom other inquiries had been held.

Alderman Tree replied for the Town Council, and submitted, with all deference to Mr. Hastings, that the municipal electric light undertaking was perfectly sound financially.

Mr. Ebenezer Elliott mentioned that many townspeople were of opinion that the electric street-lamps gave a light inferior to gas.

The inquiry then closed.

Income Tax Allowance for Depreciation.—Mr. Wilfred H. Kent, the Secretary of the Saxmundham Gas Company, Limited, has been successful in obtaining from the Income Tax Commissioners an allowance of 3 per cent. for depreciation on account of "wear and tear" of plant and machinery.

IMPROVED PUBLIC LIGHTING IN BETHNAL GREEN.

Additional Inverted Gas-Burners.

At a meeting of the Bethnal Green Borough Council last Thursday, the Works and Stores Committee reported that they had been in negotiation with the Commercial Gas Company with a view to improving the public lighting in their area in the borough by means of inverted burners; and the Committee submitted for consideration an improved scheme, on exactly the same terms as those entered into with the Gaslight and Coke Company. The area in question is at present lighted by 145 lamps (122 fitted with one burner, 19 with two burners, two with three burners, and two special lamps), which give a total light of about 10,920 candles at an annual cost of £464 19s. 4d. The Commercial Gas Company would, it was stated, be prepared to provide and fix along a portion of Bethnal Green Road indicated 19 new all-copper circular lamps, fitted with three inverted burners (to take the place of the existing 19 two-burner lamps); also to fix 31 two-burner lamps in certain thoroughfares named, and convert the remaining 94 single upright burner lamps into single inverted lamps, providing new lanterns where required. If the Council entered into a contract for five years for the supply of gas to, and the maintenance of, the 145 lamps (or any additional lamps required), the Company would be prepared to supply all the necessary lamps and burners and carry out the whole work of conversion, transfer, and installation for the sum of £230, and reduce the existing annual charge from £464 19s. 4d. to £427 10s.—thereby saving the Council £37 9s. 4d. per annum. The total lighting value of the proposed inverted burner lamps would be upwards of 20,710 candles, compared with 10,920-candle power at the present time; giving an increase of 89 per cent. It is proposed that the total number of lighting hours be reduced from 4300 to 3940 per annum, to correspond with those of the Gaslight and Coke Company, which are the average throughout London. In conclusion, the Committee recommended the Council to enter into a contract with the Commercial Company for a period of five years on the terms stated; and this was agreed to.

GAS-WORKS EXTENSIONS AT HEBDEN BRIDGE.

Controversy over a Gasholder Site.

We learn from a local paper that important projects for gas-works extensions are before the public of Hebden Bridge and Sowerby Bridge. With regard to the latter, the question has progressed so far that a Local Government Board inquiry has been held, and instructions given for the preparation of a Provisional Order to sanction the borrowing of £15,000 for improving and extending the present gas-works. At Hebden Bridge, the proposals of the Hebden Bridge and Mytholmroyd Gas Board to purchase the Calder Holmes for gas-works extensions has aroused a good deal of criticism. These holmes are the only playing-fields there are for the town, and, naturally, that considerable section of the public who set a value upon such institutions have been alarmed at the thought that the fields were about to be taken from them. The Chairman of the Gas Board (Mr. James Simpson) believes the purchase of the land in question to be an absolute necessity. The Board could not buy a part without buying the whole of the two fields. But the present intention is to use only one field; and the Chairman goes so far as to say that the position of the Board in the matter is such that if some proposition were brought forward on the part either of the Hebden Bridge Council or some rich philanthropist to purchase the ground known as the football and cricket field as a recreation ground for the town, the Board would not stand in the way. A long discussion on the subject took place at a recent meeting of the District Council, when a member argued that there was sufficient land near to the gas-works for a new holder. This view was not, however, sustained by the other speakers. The most interesting part of the discussion was the suggestion, which was followed up by a notice of motion, that the surplus land should be purchased by the Council, and devoted to the public use.

REBATES TO ALDERSHOT GAS CONSUMERS.

It may be remembered that in the "JOURNAL" for the 4th of October last, Mr. R. W. Edwards, the General Manager and Secretary of the Aldershot Gas, Water, and District Lighting Company, gave an interesting account of the method adopted by the Company of attracting additional out-district consumers of gas for cooking, heating, and motive power by the offer of rebates. The amount allowed was 6d. per 1000 cubic feet; but a difficulty presented itself in the matter of the registration of the quantity of gas used for the special purposes entitling the consumer to the rebate. After extended experiment with rotary meters—utilizing them only for arriving at the amount of the rebate, and not as a basis of account—these were adopted, and the name of "rebate indicator" given to them. Mr. Edwards stated in his article that the consumers thoroughly appreciated the system, which enables them to utilize gas for other purposes than lighting at a reduced cost. We learn from a circular recently issued that the Company are introducing the system, with certain reservations and modifications, into their urban district; and that those consumers whose only artificial illuminant is the Company's gas, or who generate electricity with it as motive power, will be allowed a rebate of 6d. per 1000 cubic feet off the ordinary rate for all gas consumed for this purpose or for cooking and heating. As the present price in Aldershot is 2s. 6d., the rebate will bring it down to 2s. per 1000 cubic feet. This concession is granted upon certain conditions, which were set forth in the article already referred to and are also contained in the circular.

The total consumption of gas being registered as hitherto by the consumer's ordinary meter, the quantity on which the rebate is to be allowed is ascertained by means of the indicator already referred to, which is fixed to the internal pipes on the consumer's premises at a point or points the Company select. No charge is made for fixing these indicators; but a small rental of 6d. per quarter is charged to the consumer in respect of each, in addition, of course, to the rent of the ordinary meter. In cases where the consumption for cooking, heating, or motive power is larger than can be satisfactorily registered by the indicator, the Company will fit an ordinary meter upon the supply for

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 364.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,863	Stk.	Oct 14	5	Alliance & Dublin Ord.	81–84	..	5 13 1
374,000	Stk.	Jan. 13	4	Do. 4 p.c. Deb.	91–93	..	4 3 4
200,000	5	Oct. 28	7	Bombay, Ltd.	⅛ 7	..	5 0 0
40,000	5	..	7	Do. New, £4 paid	5–5⅛	..	5 1 10
50,000	10	Aug. 31	15	Bourne-mouth Gas and Water } B 7 p.c.	28½–29½	..	5 1 8
311,810	10	..	7	Pref. 6 p.c.	14⅜–15⅝	..	4 3 7
75,000	10	..	6		14⅜–15⅝	..	3 18 8
380,000	Stk.	Aug. 12	12½	Brentford Consolidated	257–260	+3	4 16 2
330,000	..	..	9½	Do. New	199–202	+2	4 14 1
50,000	..	..	5	Do. 5 p.c. Pref.	120–122	..	4 2 0
206,250	..	Dec. 15	4	Do. 4 p.c. Deb.	98 100	..	4 0 0
220,000	Stk.	Aug. 31	11	Brighton & Hove Orig.	219–222	+1	4 19 1
246,320	..	..	8	Do. A Ord. Stk.	159–162	+1	4 18 9
469,000	20	Sept. 23	10⅝	British	44–45	..	4 14 5
109,000	Stk.	Aug. 11	6	Bromley, A 5 p.c.	119–121	..	4 19 2
165,700	..	..	4⅜	Do. B 3½ p.c.	89 91	..	4 15 11
82,278	..	..	5½	Do. C 5 p.c.	109–111	..	4 19 1
55,000	..	Dec. 31	3½	Do. 3½ p.c. Deb.	84–86	..	4 1 5
250,000	Stk.	..	4	Buenos Ayres 4 p.c. Deb.	95–97	..	4 2 6
100,000	10	—	—	Cape Town & Dis., Ltd.	3⅞–4⅛	+⅛	—
100,000	10	—	—	Do. 4½ p.c. Pref.	6–6½	+3/4	—
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	—	..	—
100,000	Stk.	Dec. 30	4½	Do. 4½ p.c. Deb. Stk.	88 –90	..	5 0 0
157,150	Stk.	Aug. 14	5	Chester 5 p.c. Ord.	109½–111½	..	4 9 8
1,513,280	Stk.	..	5/9/4†	Commercial 4 p.c. Stk.	113–116	+1	4 14 3
560,000	..	..	4 5††	Do. 3½ p.c. do.	103– 10	+1	4 13 11
475,000	..	Dec. 15	3	Do. 3 p.c. Deb. Stk.	77–79	..	3 15 11
800 000	Stk.	..	4	Continental Union, Ltd.	92–95	+3	4 4 3
200,000	..	..	7	Do. 7 p.c. Pref.	134–136	..	5 2 11
402,270	Stk.	—	5½	Derby Con. Stk.	122–124	..	4 8 9
55,000	..	—	4	Do. Deb. Stk.	104–105	..	3 16 2
149,995	..	Oct. 14	5	East Hull 5 p.c. Ord.	103–105	..	4 11 3
486,090	10	Jan. 27	12	European, Ltd.	2¾–2¼*	..	4 19 0
354,060	10	..	12	Do. £7 10s. paid.	18 –18⅜*	..	4 17 3
16,179,445	Stk.	Aug. 12	4⅜	Gas light and Coke } 4 p.c. Ord.	107–108	..	4 6 4
2,600,000	..	..	3½	3½ p.c. max.	87– 89	..	3 18 8
4,062,235	..	..	4	4 p.c. Con. Pref.	103–105	..	3 16 2
4,531,705	..	Dec. 15	3	3 p.c. Con. Deb.	78–80	..	3 15 0
258,740	Stk.	Sept. 15	5	Hastings & St. L. 3½ p.c.	94–56	..	5 4 2
82,500	..	..	6½	Do. do. 5 p.c.	114–116	..	5 12 1
70,000	10	Oct. 14	11	Hongkong & China, Ltd.	17¼–17¾	..	6 4 0
131,070	Stk.	Sept. 15	7⅜	Ilford A and C	147–150	+1	4 18 4
65,782	..	..	5⅛	Do. B	116–118	+1	4 19 6
65,500	..	Dec. 30	4	Do. 4 p.c. Deb.	95–98	..	4 1 8
4,940,000	Stk.	Nov. 11	9	Imperial Continental	185–187	..	4 16 3
1,235,000	Stk.	Aug 12	3½	Do. 3½ p.c. Deb. Red.	14–96	..	3 12 11
200,242	Stk.	Aug. 31	6	Lea Bridge Ord. 5 p.c.	122– 24	..	4 16 9
561,000	Stk.	..	10	Liverpool United A.	220–222	..	4 0 1
718,100	..	..	7	Do. B	164–165	..	4 4 10
306,083	..	Dec. 31	4	Do. Deb. Stk.	112–114	..	3 16 11
75,000	5	Dec. 15	6	Malta & Mediterranean.	4⅜–5	+⅛	6 0 0
560,000	100	Oct. 1	5	Met. of 5 p.c. Deb.	1.4–1.4	+2	4 16 2
250,000	100	..	4½	Melbourne 4½ p.c. Deb.	102–104	+2	4 6 7
541,920	20	Nov. 11	3½	Monte Video, Ltd.	12¾–12⅞	..	5 9 10
1,775,892	Stk.	July 28	4⅜	Newc'tle & G'tesh'd Con.	114–114½	..	4 5 4
529,435	Stk.	Dec. 30	3½	Do. 3½ p.c. Deb.	89–90	..	3 17 9
55,940	10	Aug. 31	7	North Middlesex 7 p.c.	15⅜–14⅝	..	4 16 7
300,000	Stk.	Nov. 30	8	Oriental, Ltd.	139–141	+2	5 13 6
60,000	5	Sept. 15	8	Ottoman, Ltd.	⅞–7	+¼	5 14 4
31,800	53	Aug. 31	13	Portsea Island A.	133–135	..	5 1 8
60,000	50	..	13	Do. B.	126–128	..	5 1 7
100,000	50	..	12	Do. C.	119–121	..	4 19 2
114,800	50	..	10	Do. D and E.	103–105	..	4 15 3
398,490	5	Oct. 28	7	Primitiva Ord.	7⅛–7⅜	+⅛	4 10 4
796,980	5	Dec. 30	5	Do. 5 p.c. Pref.	5¼–5⅜	..	4 10 11
488,900	100	Dec. 1	4	Do. 4 p.c. Deb.	95–97	..	4 2 6
312,650	Stk.	Dec. 30	4	River Plate 4 p.c. Deb.	55–97	..	4 2 6
250,000	10	Sept. 29	9	San Paulo, Ltd.	15¼–16	+¼	5 12 6
115,030	10	..	6	Do. 6 p.c. Pref.	11⅞–12¼	..	4 18 0
125,000	50	Jan. 3	5	Do. 5 p.c. Deb.	50–51	..	4 18 0
135,000	Stk.	Aug. 31	10	Sheffield A	232–234	+1	4 5 6
269,984	..	..	10	Do. B	231–233	..	4 5 10
533,500	..	..	10	Do. C	231–233	..	4 5 10
70,000	10	Oct. 14	6	South African	10⅞–11	..	5 9 1
6,429,895	Stk.	Aug. 12	5/9/4	South Met., 4 p.c. Ord.	121–123	..	4 8 10
1,835,445	..	Jan. 13	3	Do. 3 p.c. Deb.	78½–10⅜	..	3 14 6
209,822	Stk.	Aug. 31	8	South Shields Con. Stk.	155–157	..	5 1 1
605,000	Stk.	Aug. 12	5⅜	S'th Suburb'n Ord. 5 p.c.	120–122	..	4 12 9
60,000	..	..	5	Do. 5 p.c. Pref.	120–122	..	4 2 0
117,058	..	Jan. 13	5	Do. 5 p.c. Deb. Stk.	122–124	..	4 0 8
502,310	Stk.	Nov. 11	5	Southampton Ord.	111–113	+1	4 8 6
120,000	Stk.	Aug. 12	7	Tottenham and } A 5 p.c.	144–146	+1	4 15 11
483,940	..	..	5⅛	B 3½ p.c.	117–119	+2	4 12 5
149,470	..	Dec. 15	4	Edmonton 4 p.c. Deb.	58–100	..	4 0 0
182,380	10	Dec. 30	8	Tuscan, Ltd.	9–9½	..	8 8 6
149,900	10	Jan. 3	5	Do. 5 p.c. Deb. Red.	98–100	..	5 0 0
236,476	Stk.	Aug. 31	5	Tynemouth, 5 p.c. max.	114–115	..	4 6 11
255,636	Stk.	Aug. 31	6¾	Wands- B 3½ p.c.	143–145	+1	4 13 1
85,765	..	Dec. 30	3	worth 3 p.c. Deb. Stk.	73–75	..	4 0 0

Prices marked * are "Ex. div." † Next dividend will be at this rate.

these purposes, charging rent for this meter at half the ordinary rate. The introduction of an alternative to the indicator, by offering an ordinary meter at half rent, meets a point which experience has brought out. The indicator is more suitable for fires and small cookers; but for larger cookers ordinary meters are preferable. No rebate is allowed to consumers using slot or prepayment meters, except where a cooker or fire is separately hired, in which case the rebate may be claimed in respect of gas used therein. In order to meet the requirements of these consumers, the Company let on hire, to them only, a convenient cooker or fire at the special rent of 1s. 6d. per quarter, to include the rent of the indicator.

SALFORD GAS CHARGES.

Costs in the Recent Meter-Rents Test Case.

At the Meeting of the Salford Town Council last Wednesday, several matters arising out of the re-imposition of gas-meter rents by the Corporation, and its subsequent abandonment owing to vigorous protests by consumers, were under discussion. On the minutes of the Gas Committee being submitted for confirmation,

Mr. PURCELL, who is one of the Labour members, asked the Mayor (Alderman Phillips), as Chairman of the Gas Committee, why it was there was no record that the Solicitors for Mr. Cooke, the Chairman of the Ratepayers' Association, had presented a bill for 16 guineas in connection with the recent test case on the right of the Corporation to impose a charge for gas-meters. He (Mr. Purcell) understood that the Gas Committee had refused to pay the bill; and this being so, such a decision ought to have been set out in the synopsis of the Committee's proceedings.

The TOWN CLERK (Mr. L. C. Evans), replying, said he only placed on the synopsis those resolutions which bound the Council to do something. In this case, Mr. Cooke had applied for his costs, and the Committee had declined to pay them; and that was an end of it so far as the Committee were concerned.

Alderman JACKSON asked whether the Chairman of the Gas Committee considered it any easier to return the gas-meter rents now than it was when he (Alderman Jackson) raised the question in the Council some time ago, and the Town Clerk told them it was too difficult, and could not be done.

The TOWN CLERK said he had expressed the doubt as to whether the Corporation could return the rents, inasmuch as they had been collected, and legally collected as they thought at the time. The Court had decided that the charges were legally made, but considered that the Corporation ought to have given notice of their intention to charge for the meters. Therefore the case on the charging of meter-rents failed on a technical point. This being so, they were entitled in law to return the money already paid by consumers as meter-rent charges; whereas they (the Corporation) thought at that time they could not do so.

The minutes were confirmed.

Comparison in Prices.

At one of the public meetings called in Pendleton to protest against the charges made for gas by the Salford Corporation, Mr. Purcell said that one of the questions to be asked was why there should be such comparatively heavy charges for gas, when for fifteen years in succession they had been paid higher prices for coke than Manchester. This helped to increase the income of the Gas Committee; and consequently it ought to help to lower the charges for gas. For fourteen out of fifteen years, Salford had had higher prices than Manchester for residuals. Even more important was the fact that in eleven years out of the fifteen the prices the Salford Gas Committee had paid for coal were lower than the Manchester Committee had paid. For six years out of the fifteen, they had been able to obtain coal at a less cost than any of the nine principal municipal undertakings in the country. Why, then, should the price the consumers now paid for gas be higher in Salford than in Manchester? For twelve years out of the fifteen their prices in Salford had been higher than those of Manchester.

Taking the principal undertakings, and leaving out Liverpool, where the concern was in private hands, Salford was the highest of all in regard to the prices charged for gas. [The speaker cited the charges in various towns in support of his statement.] These were a number of towns selected just at random. If they went a little further, and included Sheffield, Wigan, St. Helens, and Widnes, Salford was "miles behind" so far as the cheapness of gas was concerned. There were places where gas was supplied at 1s. 2d. per 1000 cubic feet; and in St. Helens the difference between slot-meter and ordinary consumers was only 2d. The growing advance in the use of electricity meant that it was a very dangerous thing to have a debt of £560,000 on their gas undertaking. This had been brought about in Salford simply because of the desire on the part of certain members of the Corporation to afford relief to the rates rather than free the undertaking from debt. The present charges for gas, as he had shown by his comparisons with other towns, were unwarrantable. A resolution protesting against the present gas charges was passed, and a further motion agreed to call upon the Mayor to convene a town's meeting to consider the question of an investigation being made as to the working and financial position of the gas undertaking.

In the Chancery Division of the High Court of Justice last Tuesday, the case of *Burgess v. East Coast Water Company, Limited*, came before Mr. Justice Joyce on a motion for judgment in default of appearance or defence by the Company. Mr. Earle stated that the plaintiff was the holder of £800 debentures out of a total issue of £12,000. The interest was in arrear, and the principal money had consequently become due. His Lordship entered the usual judgment in a debenture-holder's action.

SEEING is BELIEVING.

IF you have not yet verified all that we have said in these pages regarding the unique claims of the STEAMLESS RADIATOR, it is easy to do so. Pay a visit to one of our Showrooms, where Radiators may be inspected under actual working conditions. We merely desire to remind you *now* that every claim put forward for the "Steamless" is a proof of its triumph in the matter of

MAINTENANCE.

The Davis Gas Stove Co., Ltd., Luton.

Note our Show-Room Addresses:

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Manchester Show-Rooms: 4, VICTORIA ARCADE, DEANSGATE. (Phone: 4689 City.)
Paris Show-Rooms: 82, RUE D'HAUTEVILLE.

GAS MATTERS IN MANCHESTER.

At last Wednesday's Meeting of the Manchester City Council, on the minutes of the Electricity Committee coming forward for consideration, Mr. Abbott alluded to the report of the conference between the Gas and Electricity Committees which had been referred to a Special Sub-Committee, and asked that this report should be read. The Lord Mayor (Mr. Charles Behrens), however, declined to have the question raised. Mr. Ross Clyne remarked that only members of the Gas and Electricity Committees knew about the report; and, seeing that all members of the Council were taking an interest in the question, they should know what the report was.

Later, in moving the adoption of the minutes of the Gas Committee, reference was made by Alderman Gibson to the proposed high-pressure gas lighting in Mosley Street and St. Peter's Square. It was, he said, a system which had been extensively installed both at home and abroad; and the Committee were of the opinion it should be tried in Manchester in one of the principal streets. When the matter was brought before the Council a month ago, he was taken by surprise; for he did not think there was a man in Manchester to be found who objected to the Committee experimenting in lighting streets like Mosley Street. He hoped to lighten the heart of his friend Mr. Jennison, and to give 3 cubic feet more gas for 1d. to the slot-meter users. Still, if they were to be met with such opposition in their endeavour to improve the lighting of the streets, it seemed that their efforts were hardly worth consideration at all. An amendment was moved that the matter be referred back; Alderman Walker (while stating that he did not speak as a member of the Electricity Committee) arguing that, before any new system was adopted, the matter should come before an impartial Committee, composed of members of the Gas, Electricity, and Finance Committees. Mr. Billam said it was not yet time to scrap the gas undertaking in favour of electricity. There was no contest between gas and electricity for the street lighting of Manchester. The contest now was between high and low pressure gas. Mr. Howell thought the question should stand over until the relationships between the Gas and Electricity Committees were mutually adjusted. On behalf of the Electricity Committee, Mr. Howarth expressed the opinion that it would be a good thing if the Council would let the two Committees light a street each.

In reply, Alderman Gibson said the matter was a storm in a teacup. The proposal of the Committee was merely an experiment. They would put a special meter down, so that they would know what the cost of lighting this particular street would be. The Committee so far had never been able to put intensified gas light where it could properly be tested; and no street was so well adapted to the experiment as Mosley Street. The Committee simply asked permission to make the experiment, and see what the cost of the installation was. They were not asking for anything unreasonable or unfair.

Subsequently, the mover of the amendment asked permission to withdraw it; and the minutes were thereupon allowed to pass.

LECTURES TO IRONMONGERS' ASSISTANTS.

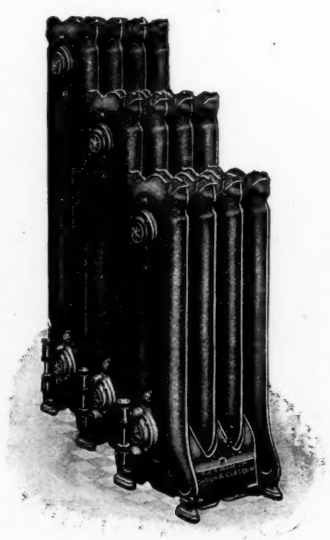
Mr. John Bond on Gas for Lighting and Heating.

The Gas Engineer and Manager of the Southport Corporation (Mr. John Bond) has arranged a series of lectures to the workmen, assistants, and apprentices of the ironmongers and plumbers of the town; and the first was given in the Science and Art School at Southport on Monday evening last week. Mr. Trounson (the Chairman of the Gas Committee) presided, and, introducing Mr. Bond, said he trusted that, as a result of the lectures, some of the young men would be encouraged to take up the study of the higher branches of gas engineering. We have received from Mr. Bond the following epitome of his remarks.

The lecturer began by saying that the subject of the application of gas for lighting, heating, cooking, and power purposes was one of great interest, especially to those who followed it through its various phases. It was pleasing to note that in Southport there was an interest taken in it by those who were responsible for the fixing of apparatus in which gas was used for domestic and commercial lighting and heating. The Corporation Gas Department had undertaken to deliver one lecture each month on some subject dealing with the uses of coal gas, &c.; and should the lectures prove a success, they would be pleased to inaugurate practical classes for the benefit of the assistants and apprentices following the ironmongery and plumbing trades, which it was hoped would be a benefit to them. It was their intention to give one or two lectures in connection with this course at the gas-works, so that the audience would have an opportunity of seeing the process of the manufacture of gas and residual products, and also of making themselves familiar with the various forms of scientific apparatus and appliances used for the testing of the heating value and the illuminating power of the gas supplied in Southport. Mr. Bond explained the nature of flame, and described radiation, the heat of conduction, and convection, all of which were illustrated by interesting experiments. Before describing the methods of obtaining radiant energy, he stated that in all cities and towns coal was used in grates with lavish waste of heat and valuable products, and at the same time polluted the atmosphere with particles of unconsumed carbon and acid gases which were detrimental both to people's lungs and to works of art, &c. To battle against this, cost the country much labour and money. A large amount of ammonia was lost which, by adopting other methods of heating, could be utilized as a manure in increasing grain crops, vegetable crops, &c., necessary for daily requirements.

At the close of the lecture, which lasted upwards of an hour, the thanks of the large gathering were tendered to Mr. Bond by Mr. R. M. Iddon, the Chairman of the Southport Ironmongers' Association, who expressed his belief that the outcome of Mr. Bond's efforts would be a great increase in the gas consumption in Southport.

A "MAIN" ANALOGY.



In an ordinary Radiator the average consumption of Gas is the maximum consumption of Gas,

Or

If it is adjusted to a low consumption its average heat is its minimum heat.

With the "Main" Gas-Heated Steam Radiators you steer clear of these two dangers. Our Patent Automatic Valve allows the Radiator to raise the maximum heat quickly (which in this case is the average heat) and to maintain it with the minimum gas consumption.

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NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Edinburgh and Leith Gas Commissioners held two public meetings this week. The claims of the Inland Revenue authorities are this time more pressing than they have ever been; and as there is a suspicion that the officials of the Government Department are not very ready to give help in the matter of filling up returns, it may be a guide to some to state here how the Gas Commissioners, with the assistance of legal advice, have dealt with them. In the first place, they have succeeded in obtaining from the Board of Inland Revenue a letter stating that the Board are now satisfied that the Commissioners are a statutory combination representative of local or rating authorities, and not a statutory company, as claimed by the Board. In the next place, with reference to the filling up of forms III. and IV., the Finance and Law Committee instructed the Clerk to insert the information that the Commissioners are the proprietors of the minerals below the Granton Gas-Works, but to refrain from specifying the nature of the minerals, or their value, in terms of section 23 (2) of the Finance Act, 1910. On the recommendation of the Finance and Law Committee, the Commissioners resolved that they should take no action meantime on an application by the Institution of Gas Engineers for a contribution to the funds of the Gas Publicity Committee. The Works Committee reported that, at the request of Bailie Pennell, they had instructed the Engineer to report upon the vertical retort experiments at Granton, as to their working condition, and whether successful or otherwise; and also to report as to the cost of the periodic renewals of the beds of nine inclined retorts, and as to the average lifetime of the beds. It was reported that the site of the disused gas-works at Portobello had been sold by auction at the price of £250, and that the Engineer had been instructed to remove whatever the Commissioners wished to retain.

After the municipal election in November last, complaint was made of a statement by Mr. Frank Cochrane, at meetings of electors in Leith, to the effect that members of the Corporations received privileges from the officials of the Gas Commission; and a Committee was appointed to deal with the subject. This Committee now reported that they had received a letter from a Law Agent, on behalf of Mr. Cochrane, in which he withdrew the statement complained of, and reiterated his sincere regret and his apology for having made it. The Commissioners agreed to rest satisfied with this.

Mr. D. M. Stevenson, in the Glasgow Town Council on Thursday, asked the Convener of the Watching and Lighting Committee (1) if, in the opinion of the Inspector of Lighting, the New City Road from St. George's Cross to Queen's Cross was overlighted; (2) if not, were the private streets off the New City Road very much underlighted; and (3) if the answer to question No. 2 were in the affirmative, would the Convener instruct the Inspector of Lighting to exercise his statutory powers thereanent. Mr. R. S. Brown replied that the lighting from St. George's Cross to Queen's Cross was sufficient, and that the private streets were underlighted. Mr. Stevenson's questions raised the whole matter of private street lighting; and no one knew better than he the many attempts which had been made to get Parliament to rectify the Statute governing this matter. If Mr. Stevenson's interpretation of the present Act were correct—that the Inspector of Lighting could do the work without keeping in view the fact that only 15s. per lamp was allowed in the Act—then the question of who should bear the burden of the extra cost would arise. There would be an extra charge of £6000 on the police rate, which was entirely an occupier's rate. The lighting of private streets was an owner's burden; but if this work were carried out irrespective of cost, there would be a translation of a burden, rightly an owner's one, to the occupiers. The whole matter was, to his mind, ripe for another attempt to get the Act modernized. The Act came into force in 1866, before either electric or incandescent gas lighting was in existence. He would undertake to bring the matter before the Committee.

The West of Scotland has this week been visited by a fog which has been very prolonged and of sufficient density to very greatly inconvenience the community. For three days—Tuesday, Wednesday, and Thursday—artificial lighting was in great demand; leading to a heavy drain upon the Gas and Electricity Departments. The average consumption of gas at this season of the year is about 28 million cubic feet daily. On Tuesday, it amounted to 30,955,000 cubic feet; on Wednesday, to 34,815,000 cubic feet, as compared with 27,307,000 cubic feet on the corresponding day of last year; and on Thursday, to 32,621,000 cubic feet, as compared with 29,242,000 cubic feet on the corresponding day of last year.

Last night, at one of the lectures under the auspices of the Smoke Abatement League, the fog and smoke evil was the subject of comment. Dr. Robert Crawford, a former Convener of the Health Committee of the Glasgow Corporation, who presided, said that the terrible atmosphere experienced during the previous four days was complete justification for the efforts being made—not so encouragingly received as they might be—by the Corporation and by several public-spirited men to forward a cause which was so deserving of public support. The last four days were sufficient to demonstrate that, however they must put up with the variations of weather in the shape of fog, they must try to relieve themselves of the necessity of breathing the sulphur, smut, and filth of every kind which the fog imprisoned within the city. At Coatbridge, a private Company were selling gas at 1s. 7d. per 1000 cubic feet, against the Glasgow Corporation's charge of 2s. After all, the problem was largely economic. He recalled the time when he first demonstrated to the other members of the Corporation that gas of 20-candle power, properly burned, gave a better light than gas of 25-candle power. The minimum was now down to 17-candle power; but the invention of the incandescent mantle had produced a great new era in the use of gas, and, in his opinion, there was no reason now why the minimum illuminating power should not be further reduced, even to 10 candles, in which case they would easily have gas supplied at 1s. 6d. or 1s. 4d. The point he urged was that the development of the use of gas was one of the special means to which they

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WORKS:—WARRINGTON.

looked for the amelioration of fog visitation. The practical problem at present was the development of the use of gas for heating, cooking, and every-day use, besides lighting. If the crusade against smoke were to be as successful as it ought to be, the Gas Department must take into their souls a larger view of the question of the supply of gas appliances than that of mere profit-making. The use of gas appliances was not being pushed by the Corporation in the way in which a private business would push it. A private company would have a canvasser in every house in Glasgow within the next six months. They would advertise—in the newspapers and by pamphlets—and would exploit the whole thing in every direction. They would even give away free large quantities of the minor appliances. In this way they would create a large daily demand, a big daily profit, and at the same time contribute greatly towards the solution of a problem which had many sides, and which it would take many years to overcome. Mr. Peter Fyfe, the Chief Sanitary Inspector for the city, was the lecturer. His subject was "The Pollution of the Air: Its Causes, Effects, and Cure." He also made reference to the disagreeable atmospheric conditions experienced during the week, and said they did not require figures and dry statistics to prove to them how rapidly the fog quenched human life. Only the Corporation could adequately tackle the problem of the introduction and distribution of gas. Was it too much to anticipate that Glasgow would in the near future produce a man of administrative genius who would solve the air-purification problem as others had solved the pure-water problem and the river purification? With the hour almost inevitably came the man; and it was their privilege, as well as their duty, to humbly prepare the way for him.

A Sub-Committee of the Cleaning and Lighting Committee of the Edinburgh Town Council had under consideration on Monday a motion by Councillor Douglas Elliot, proposing that an incandescent gas-burner should be introduced into common stairs, which would burn less gas than the burners at present in use. The Lighting Inspector reported that experiments with smaller burners had been tried in different parts of the city, but that they had not been satisfactory. There were 738 stairs and 2583 jets. Had the light from the smaller burner been satisfactory, it would have meant a saving of £295 a year. The Committee, in view of the report by the Inspector, resolved to recommend no action.

In the Elgin Town Council on Monday, the Gas Committee reported that, having considered a remit as to the price to be charged for gas supplied for cooking and heating, and to large consumers for motive power, they could not in the meantime see their way to recommend the Council to make any alteration in the price of gas for these purposes, in view of the general reduction of 5d.—from 3s. 9d. to 3s. 4d.—recently made. They considered that the subject should be continued till it should be seen what the effect of the reduction would be. This was agreed to.

On the invitation of the Gas Committee of the Peterhead Town Council, the technical class in connection with the evening continuation school at Peterhead Academy paid a visit to the Corporation Gas-Works last Saturday afternoon. There were about sixty visitors.

CURRENT SALES OF GAS PRODUCTS.

[For Table of "Tar Products Prices," see p. 400.]

LIVERPOOL, *Feb.* 4.

Sulphate of Ammonia.

Owing to the scarcity of supplies, occasioned by many of the large makes having been sold in advance, the volume of business has become somewhat restricted; but there is no lack of strength in the tone of the market, and during the week a fresh record has been established in values for the past fifteen years. Those parcels which were offered have been keenly bid for; and the quotations at the close are £13 11s. 3d. per ton f.o.b. Hull, £13 12s. 6d. per ton f.o.b. Liverpool, and £13 15s. per ton f.o.b. Leith. There is not much animation displayed for delivery beyond the next two or three months; but sales have been made at £13 10s. per ton f.o.b. Liverpool for February-June shipment, and at £13 per ton f.o.b. Leith for July-December, both lots in equal monthly quantities.

Nitrate of Soda.

The situation of this article continues very firm, and prices are well maintained at 9s. 9d. per cwt. for ordinary and 10s. for refined quality on spot.

LONDON, *Feb.* 6.

Tar Products.

The markets for tar products have remained very firm during the past week. Pitch is steady, and in some quarters higher prices are being asked. Makers are very firm in their ideas. As to benzols, although the inquiries are not so numerous, the price is well maintained. In solvent naphthas, business is not very brisk, but prices are steady. There is fair inquiry for good qualities of heavy naphtha, and altogether the market seems very steady. In crude carbolic there has been a remarkable rise during the week, and a fair amount of business has been done at the improved prices.

The average values during the week were: Tar, 18s. 9d. to 22s. 9d., *ex* works. Pitch, London, 37s. 6d. to 38s.; east coast, 37s. 6d. to 38s.; west coast, Manchester, 37s. to 37s. 6d., Liverpool, 38s. to 38s. 6d., and Clyde, 38s. to 39s. Benzol, 90 per cent., casks included, London and North, 9d. to 9¼d.; 50-90 per cent., casks included, London and North, 9d. to 9¼d. Toluol, casks included, London, 9¾d.; North, 9¼d. Crude naphtha, in bulk, London, 4d. to 4½d.; North, 3¼d. to 3½d.; solvent naphtha, casks included, London, 11½d. to 1s.; North, 10½d. to 11d.; heavy naphtha, casks included, London, 11¾d. to 1s.; North, 10¾d. to 11d. Creosote, in bulk, London, 2¼d. to 2⅜d.; North, 1⅞d. to 2d. Heavy oils, in bulk, 2⅜d. to 2¾d. Carbolic acid, 60 per cent., casks included, east coast, 1s. 7d.; west coast, 1s. 6¼d. Naphthalene, £4 10s. to £8 10s.; salts, 40s. to 45s., bags included. Anthracene, "A" quality, 1¼d. to 1¾d. per unit, packages included and delivered.

Sulphate of Ammonia.

With the commencement of the month, the buying has quieted a little; but prices are well maintained, and, in fact, at some ports

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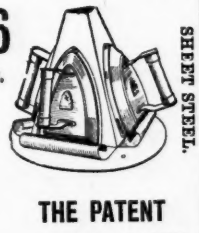

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they are a little higher. Actual Beckton is quoted to-day at £13 2s. 6d.; outside London makes at £13; Hull, £13 10s. to £13 12s. 6d.; Liverpool, £13 12s. 6d. to £13 15s.; Leith, £13 15s.; and Middlesbrough, £13 10s.

COAL TRADE REPORTS.

Northern Coal Trade.

There is a strong demand for coals, and the shipments have been very heavy, with steadier prices for some classes. Best Northumbrian steams are about 10s. per ton f.o.b., second-class steams are from 8s. 6d. to 8s. 9d., and steam smalls are a little more plentiful at from 4s. 9d. to 6s. 3d. The general tendency of the trade is to activity rather more than usual at this season of the year; and the high prices of some classes of Welsh coals are reflected here. In the Durham coal trade, gas coals are in brisk demand, which seems to be well met, so that the deliveries are heavy. Prices vary according to quality. The usual classes are from 8s. 6d. to 9s. 4½d. per ton f.o.b.; while for special "Wear" kinds, up to 10s. 6d. is the current quotation. As to contracts, there are only a few reported. They are mainly for comparatively limited quantities for some of the Baltic ports, for shipment in the middle of the year when the home demand is low; so that slightly lower prices are taken. In coke, the market is fairly firm. Good gas coke is well taken up; the current quotation being from 14s. to 14s. 6d. per ton f.o.b. in the Tyne or Wear.

Scotch Coal Trade.

Trade is not very healthy. The foreign demand is weak, and there is not sufficient activity at home to take up the output. Splint is very plentiful; and small stuffs, which were in demand a week or two ago, are now in poor request, owing to limited supplies being taken by steel and other industries. The prices now quoted are: Ell, 9s. 3d. to 10s. per ton f.o.b. Glasgow; splint, 10s. to 10s. 3d.; and steam, 9s. 3d. to 9s. 6d. The shipments for the week amounted to 288,618 tons—a decrease of 54,758 tons upon the preceding week, and of 17,286 tons upon the corresponding week last year. For the year to date, the total shipments have been 1,049,937 tons—an increase upon the corresponding period of 36,904 tons.

Oldbury Gas Undertaking.—On Friday afternoon, at a meeting of the Oldbury Urban District Council, great satisfaction was expressed at some striking increases that were reported in the consumption of gas. For the month of December, the quantity of gas sent out was 16,368,000 cubic feet, against 16,544,000 feet for the corresponding month of last year—an increase of 176,000 feet. For the nine months ending Dec. 31, the quantity sent out was 97,918,000 cubic feet, compared with 94,877,000 feet during the same period of the previous year—an increase of 3,041,000 feet.

Reduction in Price at Bodmin.—The Directors of the Bodmin Gas Company announce a reduction in price, which will now be 3s. 9d. instead of 4s. 2d. per 1000 cubic feet; while for cooking, heating, &c., it will be supplied at 3s. 3d.

Manchester-Salford Amalgamation Proposal.—After a good deal of discussion, the Salford Town Council last Wednesday approved of the appointment of a Committee of twelve, with the Mayor and Deputy-Mayor in addition, to consider the question of Salford's amalgamation with Manchester, and report thereon. A proposition that the matter should be deferred for twelve months was defeated, as was a further resolution that the scheme of amalgamation be adjourned *sine die*.

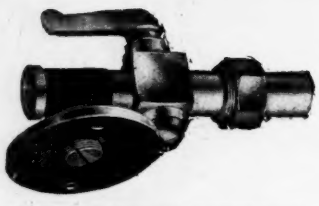
The Gas Workers' Strike in Sydney.—It may be remembered that in the account of the short strike of gas workers in Sydney which appeared in the "JOURNAL" for the 17th ult., it was mentioned that work was resumed on the understanding that the dismissed man who had caused all the trouble should be suspended during an inquiry by a Committee of employers and workmen, with Mr. Watson, a former Premier, as Chairman. The result of the investigation is unfavourable to the man concerned, who will, however, be taken back into the Gas Company's service, but will fill a lower position.

Rochdale Street-Lamp Cleaners and Extra Work.—At their meeting last Wednesday, the Gas Committee of the Rochdale Corporation considered the report of a Sub-Committee appointed to deal with an application made on behalf of the men responsible for the lighting and cleaning of street-lamps for better conditions. There are now about 3000 lamps in the borough to be attended to; and the Gas Workers' Union suggested that, in view of the increased number of lamps and the additional work falling on the cleaners consequent upon the growth of incandescent lighting, three additional men should be appointed. It was recommended by the Sub-Committee that the request should be acceded to; and the Gas Committee agreed to this.

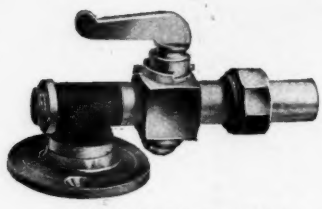
Gas Explosion near Paris.—The following paragraph appeared in "Paris Day by Day" in yesterday's "Daily Telegraph": "A tremendous gas explosion in front of a factory at Courbevoie on Saturday night, in which six persons were injured, caused no small excitement in that busy suburb. The factory is built on the site of the old château and cellars of the Comte de Larnac, and it is supposed that the gas accumulated in one of the cellars, which had only been covered and not filled in. An unpleasant odour of gas had been perceived in the factory for the last week, and the employees complained. The Gas Company sent a squad of workmen to make the repairs, and a big trench had been dug in front of the factory. Suddenly, while a large number of men and women were gathered near the office waiting for Saturday evening's pay, there was a terrific explosion, as if the whole factory had been blown up. Men and women were hurled into the air, or simply raised off their feet. The police and the firemen came to the rescue, and removed six persons who had been thrown into the trench. They were all badly injured, but, happily, their lives are not in danger. A number of other employees were only slightly hurt."

Something New!

TWO-WAY GAS FIRE TAP.



USED AS STRAIGHT-WAY TAP.



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Gas Profits and the Rates.

The following letter on the subject of the relieving of rates by means of municipal trading profits appears in the "Lancaster Guardian:" The question of the subsidies by the trading departments of the Lancaster Corporation towards relieving the rates is one that requires looking into thoroughly by the ratepayers, other than the owners of property that compound for rates. Among the glaring anomalies are the advantages enjoyed by the customers for electric light compared with those who use gas. It is many years now since the electric light undertaking contributed anything to the relief of the rates. The meaning of this is that the current is sold at the lowest possible price, and the consumers reap all the benefit. How does this compare with gas? Last year the gas undertaking contributed £3000 in cash towards the relief of the rates. But this is not all. The Gas Committee lit the public lamps free; the value of the gas supplied representing a sum of £1654. This means that the gas consumers contributed last year a sum of £4654 towards the relief of the rates, while the consumers of electric light did not contribute anything. Put in another way, the sum of £4654 is equal to a 5¼d. rate. Had the gas consumers been treated in the same way as those who use the electric light, the reduction in the price of gas would have been equal to a sum equivalent to 5¼d. in the pound on their rates. But as it is, their rates are 5¼d. in the pound more than those of the customers of the Electric Light Committee. Is this fair? Is it even equitable? One further point. The electric light is used by persons who pay their own rates; and they, which is proper, get the benefit. On the other hand, gas is largely used by the tenants of houses which are let at so much a week clear. If gas was sold on the same principle as the electric light, they (the tenants) would get the benefit. But the artificial keeping up of the price to pay handsome sums year by year towards the relief of the rates benefits the owners to the greatest extent.

Payment for a Water Diviner's Services.

The Local Government Board have upheld an appeal by the Redcar Urban District Council against the decision of the District Auditor, who refused to pass the amount for services and expenses paid to a water diviner for advising the Council as to additional sources of water supply; and a letter to this effect was submitted to the Council at their last meeting. The Auditor alleged, in effect, that in employing the services of the diviner the Council did not select as their agent a properly qualified person, and did not act with the diligence and prudence they were bound to exercise. The Board did not consider that the Auditor's decision could be sustained. They said the Council were entitled to pay the reasonable cost of obtaining advice in this matter, and it was competent to them to consult the water diviner if they had good grounds for considering him capable of giving useful advice. The Council had adopted satisfactory advice from him previously; and they could not be held to have acted without justification in incurring the expenditure in question. They therefore reversed the decision.

New Water-Filters for Bolton.

At the recent formal opening of the new pressure filters, at Fern's Park and at Sweetloves, in connection with the water-works of the Bolton Corporation, the Chairman of the Water Committee (Mr. William Rimmer) referred to the huge character of the undertaking. He said that in Bolton water was consumed at the rate of 30,000 tons a day; or, to put it differently, if the quantity were brought in water-carts, and each cart carried 30 cwt., they would have a procession of such vehicles extending from Bolton to Blackpool. The average consumption was fully 6½ million gallons per day, or 45 million gallons a week. The area within the water limits was 70 square miles, with a population of 300,000. The regions from which an uncontaminated supply could be obtained constantly became more distant and limited. At one time it was suggested that Bolton should go to the upper reaches of the Hodder, where there was a large, comparatively pure, and unappropriated supply. These conditions had forced upon water-works authorities not merely the question of water supply but that of water purification. The new filters at Fern's Park are capable of dealing with 144,000 gallons of water per hour. The plant consists of 24 filters, each 8 feet in diameter, arranged in two sets of twelves. At the Sweetloves station, the plant consists of 16 filters, each 8 feet in diameter, and arranged in two rows of eight each.

Bungay Water Company's Financial Position.—A meeting of the shareholders in the Bungay, Harleston, and Eye Water Company was held last Wednesday, at the Westminster Palace Hotel, to consider the position of the concern. The proceedings were conducted in private; but, according to a report furnished to the "Financial News," the result was the reference of the accounts to a chartered accountant, for him to audit and report upon.

A Curious Situation.—The following statement of a curious state of affairs at Llangollen appeared in last Friday's "Liverpool Post:" The liveliest interest is shown at Llangollen in regard to an extraordinary situation which arose at the Urban Council meeting on Wednesday evening. It appears that for several hours the members discussed, without progress, the desirability of making certain payments to the Electric Light Company. The reason for this absurd position lay in the fact that, roughly, half the members of the Council were either Directors or shareholders of the Electric Company, and supported the payment being made; whereas the other half were either Directors or shareholders in the Gas Company, and resolutely opposed the payments. Only one member was a disinterested party; and his vote was negatived by a conscientious member who refrained from voting at all on account of his interest in one of the concerns. Suggestions and resolutions were made *ad libitum*, but without avail; the two cliques supporting their respective opinions with absolute rigidity. Eventually, the Chairman was compelled to declare the meeting closed, nothing having been definitely arranged. A suggestion that the Town Clerk of Chester should act as Arbitrator was opposed by the electric light fraternity.

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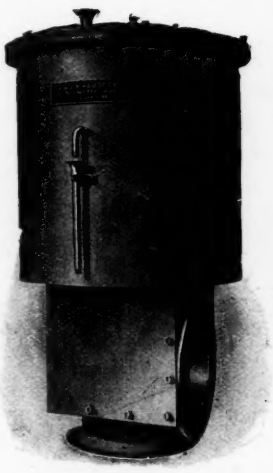

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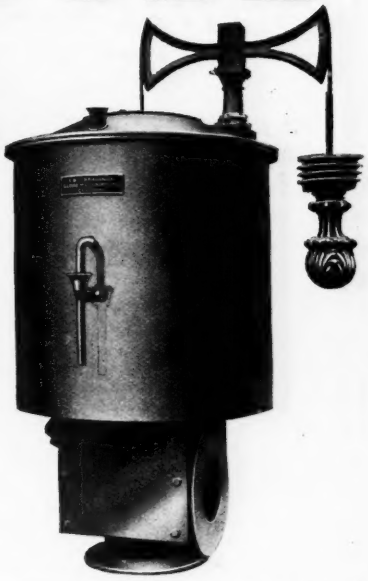

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Gas and Water Discounts at Leeds.

The following proposition was carried at last week's meeting of the Leeds City Council: "That the resolution passed by the Council on Sept. 23, 1885, to allow a discount of 5 per cent. upon accounts for gas and water paid within one month of the account being furnished to the consumer, and 2½ per cent. if paid within two months, and the resolution of the same date that the accounts be issued half yearly, be rescinded, and that the Council resolve that, from and after June 30, 1911, a discount of 5 per cent. be allowed upon accounts for gas and water paid within one month of the accounts being furnished to the consumer, and that such accounts be issued quarterly." Alderman Wilson, in submitting the motion, said that in connection with the gas accounts 71½ per cent. of the consumers on an average had taken the 5 per cent. discount; 9 per cent. had taken the 2½ per cent. discount, and the remaining 19½ per cent. had been compelled to pay in full. This resolution was to give the Finance Committee the opportunity of dealing with the matter properly. The time was shortened by one-half; and it was felt, in view of the small percentage of those who got the 2½ per cent. discount, that they ought not to stand in the way of a great administrative department. Mr. Armitage: Can Alderman Wilson tell us to what extent the rates will benefit in actual amount? Alderman Wilson: £2000 a year, and less interest.

Public Lighting of Westminster.—The City Engineer of Westminster (Mr. James W. Bradley, M.Inst.C.E.) lately suggested that the public gas lighting which had been installed in Shaftesbury Avenue under the new contract with the Gaslight and Coke Company, should be augmented by the installation of three additional 1800-candle lamps, and that the position of one existing 1800-candle lamp by Frith Street should be altered. The Works Committee, having considered the matter, have decided in favour of the proposal at a cost of £51 for the installation, and an annual charge of £46 10s. for the maintenance and lighting of the lamps.

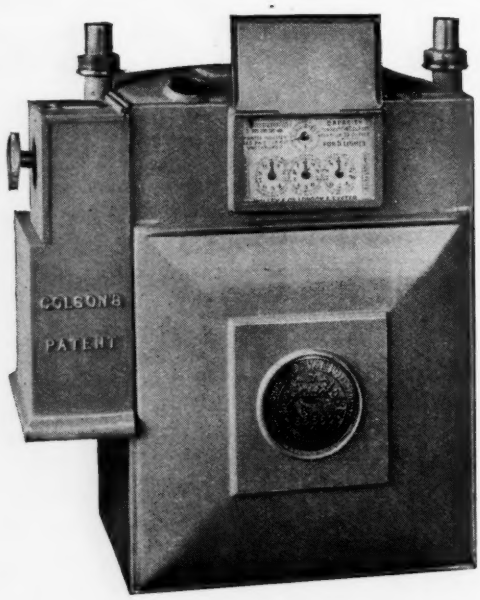
Cheaper Gas at Nottingham.—On the past quarter's accounts, a reduction has been made by the Nottingham Gas Department to general consumers of 2d. per 1000 cubic feet in the price of gas used for all purposes other than power. The scale now is: For a consumption of less than 1,000,000 cubic feet per quarter, 2s. 4d. per 1000 feet; over 1,000,000 and under 4,000,000 feet, 2s. 3d.; and 4,000,000 feet and upwards, 2s. 2d. Previously, the charge was for a consumption of less than 75,000 cubic feet per quarter, 2s. 6d. per 1000 feet; and between 75,000 and 300,000 feet, 2s. 5d. The other rates remain the same as before. The alteration made does not apply to gas used through prepayment meters, the charge for which is 3s. 4d. per 1000 cubic feet, less 1d. in the shilling rebate; nor does it refer to the districts in which special charges for gas are made under statutory provisions. For power purposes, the rates are as before—1s. 10d. per 1000 cubic feet for a consumption of under 500,000 cubic feet per annum, and 1s. 6d. if more than this amount.

Gas Prices and Profits at Halifax.

At the monthly meeting of the Halifax Town Council, certain reductions in the price of gas were proposed by Alderman Collinson, who remarked that the majority of the members of the Gas Committee were of opinion that the time had come when more consideration should be given to the gas consumers and less liberal contributions made towards the relief of rates. It was not intended to make any reduction in the special price at present in operation for gas-engines; but it was proposed to extend the field for such special price by bringing in gas used for trade purposes other than lighting. The reason for suggesting the extension of the special price to all trade purposes, other than lighting, was that they had lost numerous consumers, who had turned over to suction gas or electricity because their agitations for a special low price of gas for manufacturing had been ignored, and there was great danger that other customers would leave them unless some inducement was given. They were only selling as much gas now as they did during the year 1898-9; and yet they had to provide £12,650 more per annum for interest and sinking fund. It was proposed to make similar reductions for gas used outside the borough; and the difference between in borough and out of borough charges would remain at 7d. per 1000 cubic feet net. The total sum represented by the contemplated reductions was £4160. The gas undertaking could well afford the reductions so long as they were not used as a milch cow to provide rate-aid subsidies. Alderman Hey moved an amendment, that the proposal be referred back. He said that if the reduction of gas charges was agreed to, it would mean an addition to the rates of 2d. in the pound. There was no urgent need for a reduction of gas charges, because Halifax stood well in regard to lowness of prices. The amendment was adopted by 25 votes to 18, and was then accepted as the substantive motion.

Improved Public Lighting at Lewisham.—The Lewisham Borough Council have granted another application by the South Metropolitan Gas Company for permission to erect high-pressure lamps and columns on the public footway. In this case, the lamps are to be put up in front of certain houses in Rushey Green.

Sidmouth District Council and the Gas Company's Bill.—At the last meeting of Sidmouth Urban District Council, the General Purposes Committee reported that they had considered the proposal of the Sidmouth Gas Company for undertaking electric lighting, and, as they were of opinion that if it were passed into law it would be prejudicial in many ways to the interests of the ratepayers, they recommended the Council to file a petition in opposition to the proposal. The Chairman, in moving the adoption of the report, said they had been told that their opposition was of an acrimonious nature; but if the Bill passed, it would appear to most people to create a monopoly. Although the Council intended to oppose, they were quite prepared to listen to any reasonable suggestions or explanations which the Company might like to offer, and they welcomed any approaches which might be made by them. The recommendation was agreed to.



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SHOW-ROOMS: LONDON, 18, Adam Street, Adelphi, W.C.; DEVONPORT, 93, Fore Street.

New Joint-Stock Companies.—The following new joint-stock companies have lately been registered: Markyate Gas Company, Limited, with a capital of £3000, in £1 shares. Titchfield and District Lighting Company, Limited, with a capital of £5000, in £1 shares. Warminster Gas and Coke Company, Limited, with a capital of £12,000, in 200 shares of £25, and a like number of £20 and of £15 shares. The A to Z Inverted Gas-Lamps (Ferguson's Patent) and Fittings Company, Limited, with a capital of £1000, in £1 shares.

Fire at Richmond's Stove Works at Warrington.—A fire occurred at the Warrington works of the Richmond Gas Stove and Meter Company, Limited, in the early hours of Thursday morning last. The damage has only affected the offices and warehouse portion of the buildings, and will not occasion any serious inconvenience; the general business of the Company being carried on as usual. We are informed that the whole of the loss is fully covered by insurance. The Richmond Company are unable at the moment to acknowledge individually the many kind expressions of sympathy which have reached them from engineers and managers throughout the country, but desire to convey their thanks through our columns.

Devonport Gas Undertaking.—In the course of a speech at Devonport last Thursday night, the Mayor of the town (Alderman Littleton) said he had been told by the Gas Engineer that the output of gas last year had been 8 per cent. more than in 1909—a greater amount than had ever been known before in the history of the undertaking. The Town Clerk (Mr. R. J. Fittall), referring to the price of gas, said it must be remembered that the Corporation bought the gas undertaking when the works were practically a ruin. They had spent an enormous amount on reconstructing them; and the sinking fund charges were 6d. per 1000 cubic feet of gas sold. They had other works in hand now; and at no distant day the Corporation would be able to reduce the price and at the same time maintain the present profits.

Reduction in Price at Kingston.—The Directors of the Kingston Gas Company announce a reduction of 3d. per 1000 cubic feet in the price of gas—from 2s. 9d. to 2s. 6d. In 1869, the price charged was 5s. per 1000 cubic feet; and statistics of the growth of the Company's business in the intervening period are interesting. In 1869, the coals carbonized amounted to 7962 tons; and the amount of gas made during that year was 79,761,000 cubic feet—the leakage account being 17·75 per cent. The coals carbonized and oil equivalent used during the twelve months ended Dec. 31 last were 52,000 tons; while the leakage account at the present time is 5 per cent. The number of consumers to-day is 13,257; the mileage of mains is about 130. The Company commenced letting cooking-stoves on hire in 1890, and now have a total of 8324 so fixed. They also let out heating-stoves, cooking-stoves, lamps, radiators, &c., on the hire-purchase system, and good business has resulted from this method of business. Slot meters and cookers were first fixed in 1898; and in 1909 fittings were also supplied. At the present time, the Company are fixing a meter, stove, and four fittings or boiling-ring if required at the small cost of 5s. per installation.

The sum of £439 has been paid as bonus to the employees in the Gas Department of the Coventry Corporation.

An expenditure of £315 has been authorized by the Cowes District Council for extending the gas-works and re-erecting two purifiers.

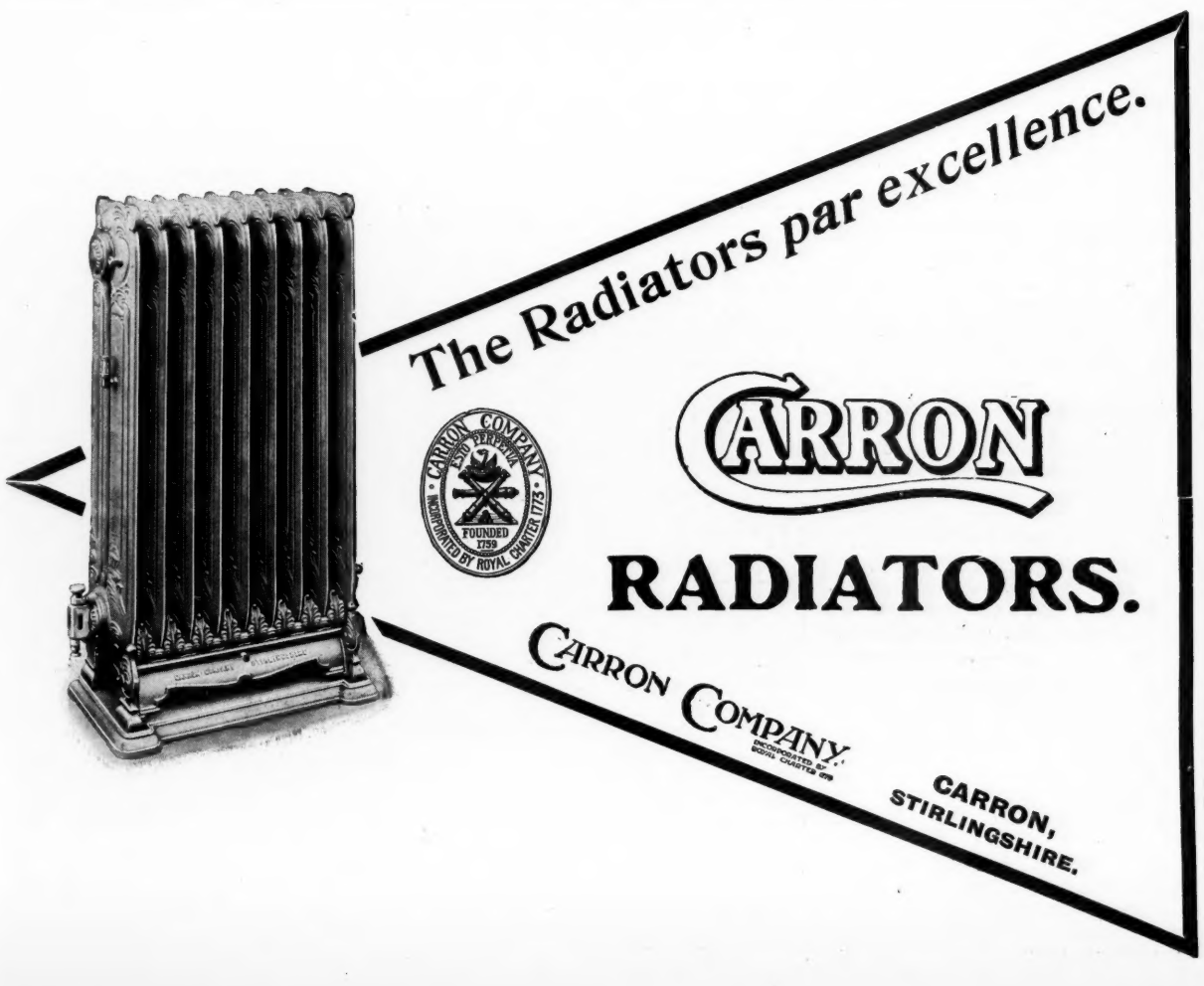
Last week the steamer *Glenbrook*, with 250 tons of coal on board for the Exeter Gas Company, entered the canal and proceeded to the basin; the Gas Company having undertaken to discharge her in 36 hours. The work was successfully accomplished well under time—in fact, in 21 hours. This is the largest steamer which has entered the canal, and represents a new departure by the Gas Company, who have hitherto used sailing vessels for the conveyance of their coal.

In another part of the "JOURNAL" will be found an intimation of the issue by Messrs. J. S. Withers and Spooner of the fourth edition of their "Guide to Patents, Trade Marks, and Designs." The object of the book is to explain to inventors the elementary steps necessary in connection with the protection of inventions and the registration of trade marks and designs. It does not profess to be exhaustive; but it deals with points on which, from their experience, the authors find inventors most frequently require information.

The Wholesale Fittings Company, Limited, Commercial Street, E. intimate that, notwithstanding that about seven years have elapsed since the "Star" inverted burner was first adopted by the Edinburgh Corporation, orders are still being from day to day received by the Company (as successors to the Star Company) for the same burner, which is manufactured in exactly the same way as it was originally placed on the market. The Company claim that, in its present form, the burner gives 70-candle power with 2½ cubic feet of gas.

The Directors of the South Staffordshire Mond Gas Power and Heating Company, in their report for the year ended Dec. 31 last, state that during the year the number of customers on the books increased from 96 to 111, and the number supplied from 90 to 102. The quantity of gas sold was 22 per cent. more than in 1909, at a slightly increased price. The profit on the revenue account is £4228. In 1909, it was £860; the difference in the two years being £3368. After adding bank interest and deducting interest on the debenture stock for the year (£3926), there is a net profit of £358, which it is proposed to carry forward. The Directors consider this progress satisfactory.

The fifth annual social gathering in connection with the Heywood Corporation Gas-Works was held on Saturday, the 28th ult., in the Conservative Club, when about seventy of the workmen and their lady friends had tea together. Mr. W. Whatmough, the Gas Engineer, presided. During the evening, Mr. M'Murdo, the Vice-Chairman of the Gas Committee, expressed his pleasure at being present and seeing the company enjoying themselves. He hoped the men would go away resolved to do their share in furthering the interests of the undertaking with which they were connected. An entertainment, with dancing, followed the tea; and a very enjoyable evening was brought to a close by the singing of the National Anthem.



From April 1, 1910, to the end of December the cash received by the Gas and Lighting Department of the Bolton Corporation was £116,567—showing an increase of £4000 compared with the corresponding period of 1909.

Mr. Frank Keep, of 9 and 10, St. Mary-at-Hill, E.C., coal, coke, and breeze factor, wishes us to state that his business is not, and never has been, in any way, connected with any other person, firm, or company trading in the same class of business.

TAR PRODUCTS PRICES.

Representative manufacturers give the following as fair current values for the week ending Feb. 4. Prices are net, and they include the usual packages and delivery f.o.b., f.a.s., or f.o.r., as customary.

Article.	Basis.	London.	North-East Coast.	East Coast, Yorks.	West Coast.		Glasgow.
					Liverpool.	Manchester.	
Tar crude	per ton	22/6	19/6 22/6	19/6 23/-	18/6 21/-	19/6 22/-	—
Pitch	,,	38/-	37/6 38/-	37/6	38/6	37/- 37/6	38/-
Benzol, 90 %	per gallon	-/10½	-/9½	-/9	-/8	-/9	-/10
Benzol, 50-90%	,,	—	-/10	-/9½	-/8 -/8¼	-/9	—
Toluol, 90%	,,	-/10½	-/9¾	-/10	-/10	-/9¾	-/9¾
Crude naphtha, 30%	,,	—	-/3½	-/3½	-/3¼ -/3½	-/3½ -/4	—
Light oil, 50%	,,	—	-/3½	-/3¾ -/4	-/3 -/3⅛	-/3½	—
Solvent naphtha, 90-160	,,	—	-/10½ -/11	-/10	-/10	-/11¼	-/11
Heavy naphtha, 90-190	,,	—	-/11	-/11½	-/11½	-/11¾	-/11
Creosote in bulk	,,	-/2⅜ -/2¾	-/2 -/2¼	-/2	-/2 1/16	-/2 1/16	-/1⅞
Heavy oils	,,	—	-/2⅛ -/3	-/2¼	-/2¾	-/2⅞ -/3	-/3
Carbolic Acid, 60's	,,	1/7 1/8	1/4½ 1/6	1/6	1/4	1/4	1/3
Naphthalene, crude drained salts	per ton	—	42/6 45/-	40/- 42/6	47/6	47/6 50/-	—
,, pressed	,,	—	60/-	63/-	60/-	60/- 72/6	—
,, whizzed	,,	—	—	—	70/- 72/6	60/- 75/-	65/-
Anthracene	per unit	-/2	-/1⅜	-/1½	-/1¼	-/1¼	—

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

HEAD CLERK AND CASHIER. Maidstone Gas Company. Applications by Feb. 16.
DISTRICT SUPERINTENDENT. No. 5351.
ENGINEER (FRENCH) FOR TAR DISTILLATION. No. 5352.
GAS-FITTER (CEARA). Ceara Gas Company. Applications to London Office.
MAINTENANCE INSPECTOR, &C. No. 5355.
TRAVELLER. No. 5354.
ASSISTANT WORKS MANAGER. Sutherland Meter Company.
REPRESENTATIVE. No. 5349.
TIME AND STORE KEEPER. Redcar Gas-Works.

Plant, &c. (Second-Hand), For Sale.

STATION METER. Oldbury Gas Department.

Meetings.

BRIGHTON AND HOVE GAS COMPANY. London Office, Feb. 24. Two o'clock.
CHICHESTER GAS COMPANY. Gas-Works. Feb. 21. One o'clock.
CHIGWELL, LOUGHTON, AND WOODFORD GAS COMPANY. Gas-Works. Feb. 15. Three o'clock.
EUROPEAN GAS COMPANY. Salisbury House. Feb. 21. 2.30 o'clock.
HORNSEY GAS COMPANY. London Office. Feb. 17. 3.30 o'clock.
RIDDINGS GAS COMPANY. London Office. Feb. 28. 3.30 o'clock.
SOUTH SUBURBAN GAS COMPANY. De Keyser's Hotel, Feb. 17. Three o'clock.
SOUTHGATE GAS COMPANY. London Office. Feb. 23. 3.45 o'clock.
UXBRIDGE GAS COMPANY. Offices. Feb. 23. 2.30 o'clock.

Stocks and Shares.

CHIGWELL, LOUGHTON, AND WOODFORD GAS COMPANY. By Auction. Feb. 14.
EPPING GAS COMPANY. By Auction. Feb. 14.
GREAT YARMOUTH WATER COMPANY. By Auction. Feb. 14.
SOUTHAMPTON GASLIGHT AND COKE COMPANY. By Tender. Feb. 28.
SOUTHEND WATER COMPANY. By Auction. Feb. 28.
SUNDERLAND AND SOUTH SHIELDS WATER COMPANY. By Auction. Feb. 22.
WALTHAM ABBEY AND CHESHUNT GAS COMPANY. By Auction. Feb. 14.

TENDERS FOR

Coal.

HUDDERSFIELD GAS DEPARTMENT. Tenders by Feb. 15.

Cookers.

BARROW-IN-FURNESS CORPORATION. Tenders by Feb. 21.

Gasholder and Tank.

BROADSTAIRS GAS COMPANY. Tenders by Feb. 21.

General Stores (Oil, Lime, Ironmongery, Sulphuric Acid, Brass Cocks, &c.).

BARROW-IN-FURNESS CORPORATION. Tenders by Feb. 21.
DEVONPORT GAS DEPARTMENT. Tenders by Feb. 11.

Meters.

BARROW-IN-FURNESS CORPORATION. Tenders by Feb. 21.

Oil for Water-Gas Manufacture.

DEVONPORT GAS DEPARTMENT. Tenders by Feb. 11.

Pipes, &c.

BARROW-IN-FURNESS CORPORATION. Tenders by Feb. 21.

Tar.

BARROW-IN-FURNESS CORPORATION. Tenders b Feb. 21.
DEVONPORT GAS DEPARTMENT. Tenders by Feb. 11.
SOUTHAMPTON COUNTY MAIN ROADS. Tenders by Feb. 20.

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For GAS PURIFICATION.
LARGEST SALE OF ANY OXIDE.

SPENT OXIDE PURCHASED IN ANY DISTRICT.

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"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
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Twice as rich as Bog Ore.
Gives no back Pressure.
The Cheapest in the Market.
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THE RELIANCE LUBRICATING OIL COMPANY, 19 & 20, Water Lane, Tower St., London, E.C. Agents wanted.